AERONAUTICAL ENGINEERING REVIEW

INSTITUTE OF THE AERONAUTICAL SCIENCES

FEBRUARY 1947

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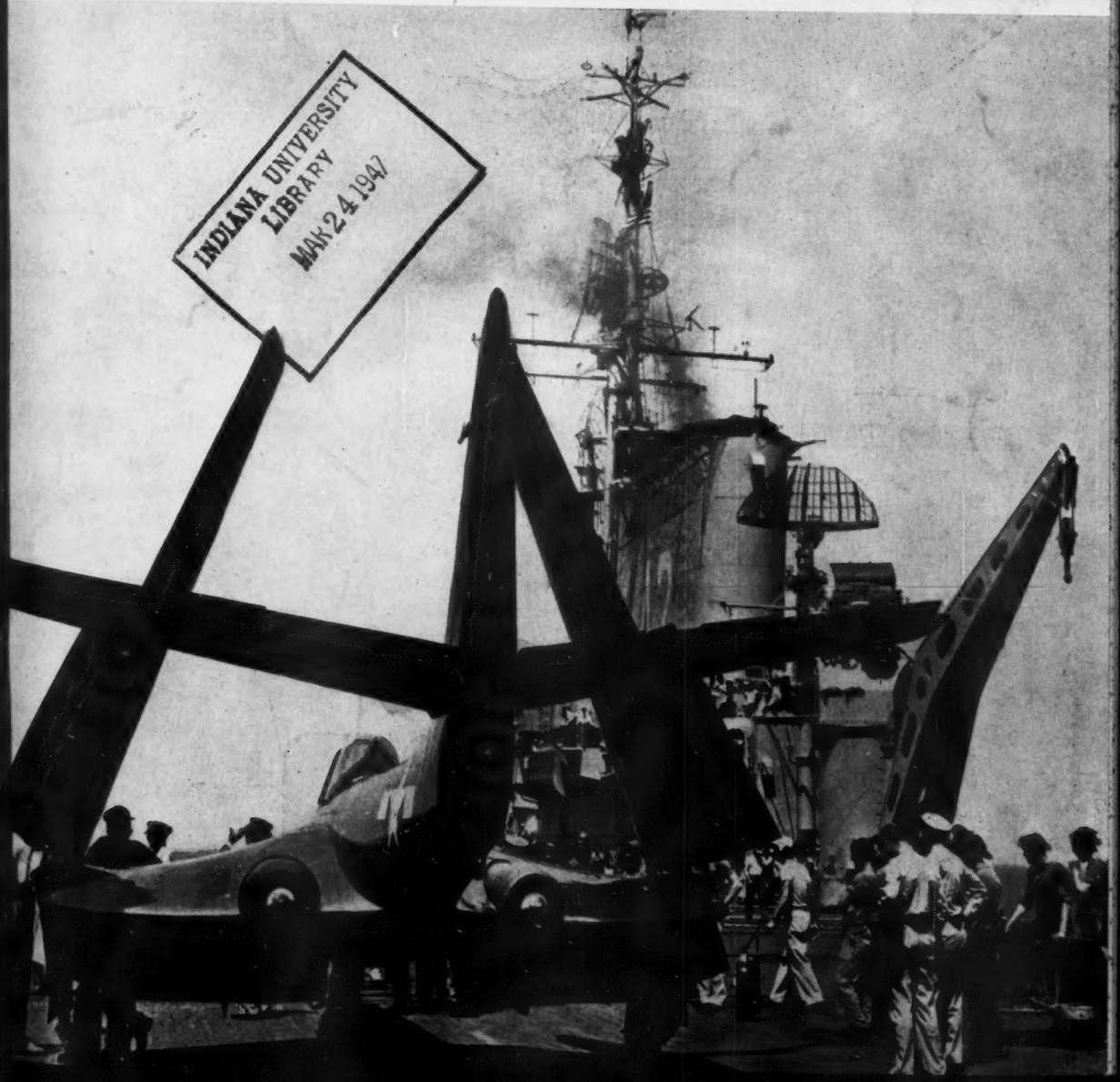

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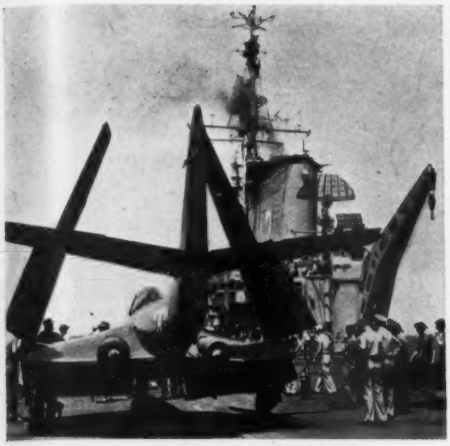

Cover—First demonstration of the ability of a twin jet-propelled fighter to operate from a carrier at sea. McDonnell XFD-1 Phantom preparing for flight from deck of U.S.S. "Franklin D. Roosevelt."

Editor
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Reviews, Managing Editor
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News Editor
John F. Mason

Reviews, Technical Editor
Edward G. Ingram

Assistant Editor
Lillian E. Bermont

Manager, Western Region
James L. Straight
6715 Hollywood Blvd., Los Angeles 28, Calif.

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AERONAUTICAL ENGINEERING REVIEW

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Published Monthly by the Institute of the Aeronautical Sciences, Inc.

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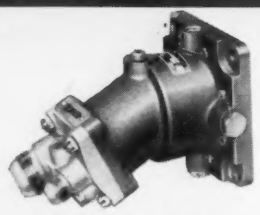

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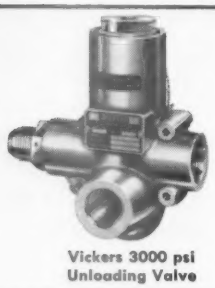
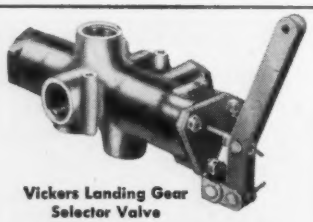
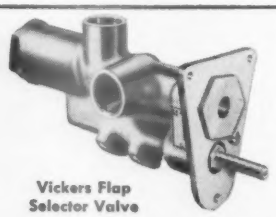


Vickers 3000 psi Unloading Valve

Vickers 3000 psi Reducing-Relief Valve



Vickers Landing Gear Selector Valve



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I.A.S. News

A Record of People and Events of Interest to Institute Members

Plans Under Way for National Propulsion Meeting

Tentative Program Announced for Technical Sessions and Dinner in Cleveland for March 28. Hunter, of N.A.C.A., Program Chairman.

With the dust barely settled after the Institute's Fifteenth Annual Meeting in New York, the outlines of the next National event, the yearly Aircraft Propulsion Meeting on March 28 are rapidly emerging. As in the preceding year, Cleveland is the locale, the Cleveland Section is our host, and the personnel of the N.A.C.A.'s Cleveland Power Plant Research Laboratories are taking an active part.

Arrangements have been made for the use of the Rainbow Room in the downtown Hotel Carter. All technical sessions, the luncheon, and the dinner will take place in the hotel. The local committee is reserving blocks of rooms in the Carter and other Cleveland hotels for the convenience of visiting members. Announcements will be included with the final meeting notices as to proper contacts for accommodations.

Because of the urgency and the nature of the work at the Engine Laboratory, no special exhibition or demonstration program could be undertaken by the N.A.C.A. this year. We are assured, however, that I.A.S. members who wish to arrive a day ahead will be welcomed at the Laboratory and may be shown as much of the work in progress there as current conditions warrant. Arrangements for such visits should be made directly with Laboratory headquarters.

The tentative program as released by the Program Committee late in January follows. It is subject to later modification.

MORNING SESSION

Chairman—A. T. Colwell

General Session

(1) Aircraft Fuels and Supplies by Mr. Blackwood, of the Standard Oil Development Corporation.

(2) High Temperature Materials by Mr. Freeman, University of Michigan.

(3) Regenerative Rocket Cooling by Mr. Reinhardt, of the Bell Aircraft Corporation.

(4) N.A.C.A. Cascade Data for Axial-Flow Compressors by Mr. Bogdonoff, of Princeton University.

AFTERNOON SESSION

Chairman—N. C. Price

Design of Gas Turbine Components

(1) Compressor Design by Mr. Hunsaker, of the Northrop-Hendy Company.

(2) Turbine Design by Mr. Eastman Jacobs, of the Harvey Machine Company.

(3) Combustion Chamber Design by Dr. Hawthorne, of the Massachusetts Institute of Technology.

(4) Gas Turbine Controls by Mr. Edwards, of the General Electric Company.

EVENING SESSION

Symposium: *Selection of Aircraft Propulsion System*

A round-table discussion is being arranged in which six N.A.C.A. men will first present short talks on the general characteristics of modern propulsion systems, such as turbojets, ram-jets, rockets, etc. This presentation will be followed by a discussion between the panel members at the table and the members on the floor, in which the characteristics of different engines will be compared so that the best engine for different flight speeds and ranges can be evaluated.

Willson H. Hunter.

Willson Hunter, in charge of the Refrigeration Section at the Engine Research Laboratory, is Program Chairman. In the collection of the papers and in setting the stage for the meetings, he has been ably assisted by a committee including Abe Silverstein, Chief, Wind Tunnel and Flight Division, N.A.C.A.; A. M. Rothrock, Chief of Research, Cleveland Laboratory, N.A.C.A.

I.A.S. Calendar

March 28, 1947	Aircraft Propulsion Meeting, Cleveland, Ohio
May 26–27, 1947	Personal Aircraft Meeting, Detroit, Mich.
August 7–8, 1947	Annual Summer Meeting, Los Angeles, Calif.

For further details see page 19.

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Vice-President, Engineering and Sales, Boeing Aircraft Company

Rex B. Beisel
Vice-President
Vice-President, United Aircraft Corporation
General Manager, Chance Vought Aircraft Division

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President, Sperry Gyroscope Company, Inc.

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(Below, left to right)
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Vice-President
Rear Admiral, U.S.N.R.
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Institute of the Aeronautical Sciences

Robert R. Dexter
Secretary
Institute of the Aeronautical Sciences

for 1947

★

Pictured on the opposite page are Institute Officers elected by the Council for 1947.

Re-elected to direct the daily working operations of the Institute are the Staff Officers shown on this page.

I.A.S. DIRECTOR
S. Paul Johnston

James L. Straight
Manager, Western Region
Institute of the Aeronautical Sciences

Joseph J. Maitan
Controller
Institute of the Aeronautical Sciences

I.A.S. Awards

★ ★ ★

Sylvanus Albert Reed Award

Presented to

ROBERT T. JONES

"For his contributions to the understanding of flow phenomena around wings and bodies at speeds below and above the speed of sound."

The late Dr. S. A. Reed, designer of metal aircraft propellers and a Founder Member of the Institute, made an endowment to the Institute in 1933 to provide an annual award with a certificate and honorarium of two hundred and fifty dollars. The recipient of this award is chosen by ballot of the American Honorary Fellows and Fellows of the Institute, who now number over a hundred of this country's leading aeronautical scientists.

Mr. Jones attended the University of Missouri and Catholic University of America taking postgraduate work in aerodynamic theory from 1928 to 1933. He worked for the Nicholas-Beasley Airplane Company during 1929 and 1930. In addition, Mr. Jones was associated with Prof. Louis H. Crook in the "Aero Lab," Washington, D.C., from 1932 to 1934. He was employed by the N.A.C.A. at the Langley Memorial Aeronautical Laboratory from 1934 until 1946, and during the period 1940 to 1946 was in charge of the Stability Analysis Section in the Langley Stability Research Division. Recently, he was transferred to the Committee's Ames Aeronautical Laboratory.

His duties have consisted of theoretical research work, chiefly in the analysis of problems relating to the dynamics of airplane motions and problems of fluid dynamics. He is the author of many N.A.C.A. reports, including "Wing Plan Forms for High-Speed Flight," "Flow over a Slender Body of Revolution at Supersonic Velocities," and "Thin Oblique Airfoils at Supersonic Speed."

Thurman H. Bane Award

Presented to

COL. LEIGHTON I. DAVIS

"For Gyro Computing Sight for aiming guns, bombs, and rockets from fighter aircraft."

This award honors the memory of Col. Thurman H. Bane, one of the most prominent technical officers of the U.S. Army Air Corps, who died in 1932. It has been endowed by Major R. H. Fleet and provides an annual certificate of citation and honorarium of two hundred dollars to the recipient selected by Award Committee.

Colonel Davis was graduated from the U.S. Military Academy at West Point in 1935 and served with the Sixth Pursuit Squadron, Wheeler Field, Hawaii, until 1938. From 1939 until 1943 he was an Instructor in the Department of Natural and Experimental Philosophy, U.S.M.A., except for 1 year, 1940–1941, when he received academic leave to study at the Massachusetts Institute of Technology. In 1942 he was awarded the Legion of Merit for his work, in collaboration with Dr. C. S. Draper, on the development of electronic pressure volume and pressure time device for internal combustion engines.

Colonel Davis later undertook the mathematical analysis necessary to extend gyro computing gun-sight theory to the aiming of bombs and rockets. Upon completion of this study he was appointed to develop a complete sighting system for fighter aircraft. Under his direction a single sighting system, capable of greater accuracy and without limitations in use as a combination gun-, rocket-, and bombsight, was developed. In the early experimental work on this project, his ability as a pilot and aeronautical engineer permitted him to conduct aerial tests personally.

Robert M. Losey Award

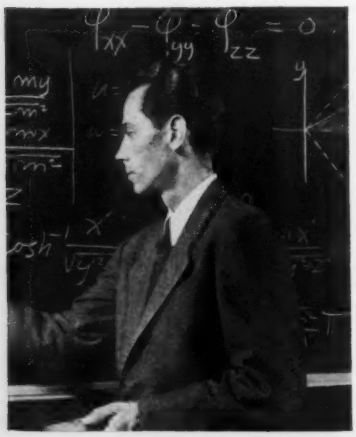
Presented to

DR. CARL G. ROSSBY

"In recognition of outstanding contributions to the science of meteorology as applied to aeronautics."

Established in 1940, this award honors the memory of Capt. Robert Moffatt Losey, a member of the Institute and a meteorologic officer of the Air Corps, who was killed at Dombas, Norway, April 21, 1940. Captain Losey was serving as an official observer for the U.S. Army. He was the first officer in the service of the United States to die in World War II.

Dr. Rossby was educated in Sweden and Norway and served as meteorologist in the government services of these countries. He came to the United States on a fellowship from the American-Scandinavian Foundation in 1926. Dr. Rossby, as Chairman of the Daniel Guggenheim Committee on Aeronautical Meteorology, organized the model air-weather service for southern and central California. He was Associate Professor of Meteorology, Massachusetts Institute of Technology, 1928–1932, and Professor from 1932–1941. Since 1931 he has been Research Associate at Woods Hole Oceanographic Institute. From 1939 to 1942 he was Assistant Chief for Research and Education for the U.S. Weather Bureau. Since 1942 he has been head of the Department of Meteorology, University of Chicago. He has also been Expert Consultant in Meteorology, Office of Secretary of War, since 1943. Dr. Rossby, former President of the American Meteorological Society, was co-recipient with H. C. Willett of The Sylvanus Albert Reed Award in 1939. Dr. Rossby is internationally known for his contributions to research on the general atmospheric circulation and the formulation of advanced techniques in weather forecasting.



For 1946

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John Jeffries Award

Presented to

BRIG. GEN. MALCOLM C. GROW

"For outstanding contributions to the advancement of aeronautics through medical research."

This award was established by the Institute in 1940 to give recognition to the importance to aviation of scientific endeavor in the field of medicine. It honors the memory of Dr. John Jeffries, an American physician who, with Blanchard, the French balloonist, made the first aerial voyage across the English Channel in 1785. On a previous voyage he made the earliest recorded scientific observation from the air.

General Grow received his M.D. at Jefferson Medical College in 1909 and was appointed Captain in the Medical Reserve, December 5, 1917. He served as Surgeon with the 45th Artillery, A.E.F., in France in 1918 and later with both the 42nd Infantry Division, Army of Occupation of Germany, and the 4th Division, A.E.F. During World War II, he was Chief Flight Surgeon of the Army Air Forces in Europe.

As Surgeon for the 8th Air Force, General Grow developed and placed in operation a device to protect gunners from wind blast; electrically heated clothing, gloves, boots, hand warmers; casualty bags for the wounded; wind- and fire-resistant face and neck protectors; and a special combat ration for use on long bombing missions. These innovations resulted in a marked decrease of frostbite cases and greatly increased the combat efficiency of the flight crews. General Grow is directly responsible for the development of the armor used by air personnel in the European Theatre during the war. This development saved the lives of, and prevented serious injury to, large numbers of flying personnel.

Octave Chanute Award

Presented to

ERNEST A. CUTRELL

"For outstanding achievement in flight testing and developing instrument landing equipment and techniques contributing to improved performance of instrument flying."

The Octave Chanute Award, established by the Institute in 1939, is given annually for notable contributions made by a pilot to the aeronautical sciences. It honors the memory of the American engineer, Octave Chanute, who died in 1910. He was a pioneer in aeronautical research and gave assistance and advice to the Wright Brothers in their early work.

Mr. Cutrell was born in Lafayette, Ind., and received his education at Earlham College and Indiana University. Prior to joining American Airlines as flight supervisor in 1935, he served as air-line inspector for the Aeronautics Branch of the Department of Commerce from 1927 to 1933. He later became instrument-landing instructor for Eastern Air Transport, Atlanta, Ga. From January, 1934, until November, 1934, he was on loan to the Department of Commerce to make blind-landing tests. During this period, he made 167 blind landings using two systems: the Army A-1 Radio Compass system and the Department of Commerce Localizer and Glide Path system.

Mr. Cutrell was granted a military leave of absence in 1942 to join the headquarters staff of the Air Transport Command. In June, 1944, he was named Commanding Officer of the Navigation and Landing Aids Unit, in which capacity he supervised all-weather flying tests on instrument-landing systems. His continuing efforts over a period of years to improve instrument-landing systems have resulted in major contributions to the air-transport industry.

Lawrence Sperry Award

Presented to

PETER R. MURRAY

"For radio controlled systems for guided missiles and pilotless aircraft."

This award was endowed in 1936 by the sister and brothers of the late Lawrence Sperry, pioneer aviator and inventor who died in 1923 at the age of 31. It provides an annual certificate of citation and honorarium of two hundred and fifty dollars to the recipient selected by the Board of Award.

Mr. Murray was born in December, 1915. He was graduated from Antioch College with a B.S. Degree in Physics. Mr. Murray has been employed with the Air Matériel Command and its predecessors at Wright Field since October, 1935. He has been with the Aircraft Radio Laboratory at Wright Field during all of his employment, including his service as an Army Air Force officer from March, 1945, to October, 1946.

Mr. Murray is at present Chief of the Special Projects Unit, Electronic Subdivision, Engineering Division. He is responsible for the technical planning of the unit and the design, supervision, and testing of experimental radio-control installations in targets, guided missiles, pilotless aircraft and vehicles.

Mr. Murray has been performing research on remote-control systems for aircraft for the past few years. The PQ series of remote-control systems, which are standard in the A.A.F. for radio-controlled aircraft, are the results of his initiative and technical abilities. A recent application of Mr. Murray's remote-control system came in the atom-bomb tests at Bikini Atoll. He devised the equipment, supervised installation, and remained with the aircraft until the completion of the tests.

Report of Honors Night Dinner

The Fifteenth Annual Honors Night Dinner of the Institute was held in the Grand Ballroom of the Hotel Astor on January 27. More than 1,000 distinguished scientists, designers, and aeronautical engineers in all fields of aviation research and development were present. Arthur E. Raymond, retiring President, presided and formally opened the program with a short address of welcome.

Mr. Raymond presented the Institute's Fellowships and Honorary Fellowships at this time. The recipients are selected by Honorary Fellows and Fellows of the Institute who reside in the United States. An Honorary Fellowship is one of the highest honors the Institute confers upon persons of preeminence in aeronautics. One Honorary Fellow residing in the United States and one from a foreign country may be elected each year. This year's foreign Honorary Fellow is Sir Geoffrey de Havilland, of The de Havilland Aircraft Company, Ltd., England. Frank W. Caldwell, Director of Research at United Aircraft Corporation, was selected to be the American Honorary Fellow.

Ten Americans and two Britishers were awarded Fellowships this year. Fellows must have attained a position of distinction in aeronautics and must have made notable and valuable contributions in one of the aeronautical sciences.

The two foreign Fellows were H. Roxbee Cox, Chairman and Managing Director of Power Jets Research and Development, Ltd., and J. Laurence Pritchard, Secretary of The Royal Aeronautical Society.

The following Americans were elected to the grade of Fellow: William G. Brown, Colonel, Office of Assistant Chief Air Staff (4), A.A.F. Liaison with National Defense Research Committee, Headquarters, A.A.F.; Emerson W. Conlon, Head of the Department of Aeronautical Engineering at the University of Michigan; S. Paul Johnston, Director of the Institute of the Aeronautical Sciences, Inc.; Jerome Lederer, Chief Engineer, Aero Insurance Underwriters; Albert E. Lombard, Engineering Consultant, Consolidated Vultee Aircraft Corporation; Russell G. Robinson, Assistant Director of Aeronautical Research, National Advisory Committee for Aeronautics; Addison May Rothrock, Chief of Research, Cleveland Laboratory, National Advisory Committee for Aeronautics; Francis R. Shanley, Division Engineer, Engineering Research, Lockheed Aircraft Corporation; Abe Silverstein, Chief of the Wind Tunnel and Flight Division, Compressibility Unit, Cleveland Laboratory, National Advisory Committee for Aeronautics; and J. Parker Van Zandt, Aviation Director of The Brookings Institution.

The Institute's six annual awards for outstanding contributions to the aeronautical sciences were presented by Mr. Raymond. They are reported on the preceding pages.

Following the presentation of Institute Awards the Hon. W. Averell Harriman spoke on "Civil Aviation—A New Economic Frontier." Excerpts from Mr. Harriman's speech will be found in the March issue of the AERONAUTICAL ENGINEERING REVIEW.

The Fifteenth Honors Night Dinner was concluded by the formal induction of the 1947 President, Preston R. Bassett, President, Sperry Gyroscope Company, Inc.

Burnham Adams.

Burnham Adams, New Manager of Lear, Inc. of California

Burnham Adams, Associate Fellow of the Institute, has been appointed Manager of Lear, Inc. of California. Prior to assuming duties with the Lear organization in 1946, Mr. Adams had been West Coast Manager of Wright Aeronautical Corporation. For several of his 23 years with this organization he had also served in the Wright Engineering Department as Sales Manager.

Mr. Adams is a graduate of the Sheffield Scientific School of Yale University. He received his Mechanical Engineering degree in 1924.

Jack Frye *(right)*, President of T.W.A., receiving the Medal for Merit from Secretary of War Robert Patterson.

Jack Frye Awarded Medal for Merit

Jack Frye, President of Trans World Airline and a Fellow of the Institute, has been awarded the United States Government's highest civilian award, the Medal for Merit.

The award, made by President Truman, was accompanied by a citation in which Mr. Frye was commended for "exceptionally meritorious conduct in the performance of outstanding service to the United States from December, 1941, to August, 1945."

The citation said in part: "As President of the Trans World Airline, you made a noteworthy contribution to the success of air operations against the enemy as a result of your broad experience in the operation of commercial air transports, and the force and vigor with which you addressed yourself to the critical conflict into which your country was projected."

In accepting the award from the Hon. Robert P. Patterson, Mr. Frye said: "It is in recognition of the part played by all T.W.A. employees that this award is given. I am proud to accept this honor on behalf of T.W.A. employees."

Dr. Harvard L. Hull, Associate Director of the Argonne National Laboratory

Harvard L. Hull, Associate Fellow of the Institute and former Director of the Process Improvement Division at Tennessee Eastman Corporation's electromagnetic plant at Oak Ridge, Tenn., is now Associate Director of the Argonne National Laboratory at Chicago. Dr. Hull joined Sperry Gyroscope Com-

pany in Brooklyn, as a Research Engineer in 1933. He later became Project Engineer and then Director of remote control development for Sperry. He was active in developing a wide variety of automatic control equipment for gyro-compasses, searchlights, antiaircraft guns, and bombsights. Dr. Hull was instrumental in developing the remote control apparatus for the 90-mm. antiaircraft gun. He also developed infrared airplane detecting equipment for the Army. He went to England in 1934 and again in 1936–1937 to introduce equipment developed at the Sperry plant in this country.

Dr. Hull is a member of the executive committee of the Oak Ridge Institute of Nuclear Studies, the Technical Advisory Committee on Isotopes of the Manhattan District, the American Physical Society, and Sigma XI.

AFITA Offers Cooperation to I.A.S. Members Visiting France

The Association Française des Ingénieurs et Techniciens de l'Aéronautique (AFITA) has extended an invitation to all I.A.S. Members coming to France to visit or communicate with its headquarters in Paris. M. Tarry, President of the AFITA, will be glad to consult with I.A.S. Members and offer any needed assistance or advice in connection with their problems. The facilities of the Institute of the Aeronautical Sciences will be available to members of the AFITA visiting the United States.

The foundation of the AFITA was suggested by the Association des Anciens Élèves de l'École Nationale Supérieure de l'Aéronautique (ENSA) (Alumni Association of the Higher National School of Aeronautics) as a means of bringing together all aeronautical engineers and technicians, whatever their origin, so that they might examine and discuss in common the technical problems of interest to them and suggest research programs and special studies. It was also to serve as a means of providing active interchange of technical information on all aeronautical subjects and of improving professional relations and as the connecting link between members of the aeronautical profession in France and abroad. The plan for the establishment of a new society was evoked by the widespread interest shown in the technical and scientific articles published in *Technique et Science Aéronautiques*, then the official organ of the Alumni Association of the ENSA, which had adopted a new policy of publishing papers by both members and nonmembers. The plan was favorably received by the official services and in industrial and scientific circles.

The aims of the society are realized by the organization of Public Meetings, Members Meetings, and Study Groups; by the issuance of *Technique et Science Aéronautiques*, a bi-monthly periodical, and other publications; and by the work of Scientific and Technical Commissions.

The Secretariat of the AFITA is located at 6, rue Cimarosa, Paris 16. Other offices are at 6, rue Galilée, Paris 8.

Gifts to the Institute Collections

The Aeromechanics Division of the David Taylor Model Basin sent 600 wind-tunnel reports, comprising a complete set for the period between January 18, 1917, and March 25, 1940. This gift was arranged through the courtesy of the Bureau of Aeronautics of the U.S. Navy Department. Mr. and Mrs. Gordon Wightman gave papers, certificates, and issues of gliding publications of their son, Henry Nicoll Wightman, adding to their previous generous gifts in his memory.

Models of an early Curtiss pusher airplane, an early Farman pusher, a Fokker triplane, a Sopwith biplane, Bleriot's 11th airplane, the GB Super Sportster, and of Garnerin and his parachute were given by Eric W. Wood. A model of the Grumman "Tigercat" fighter airplane was sent by that company through the courtesy of Roger Wolfe Kahn. Breast wings and pilot's cap and cap badge were sent by Southwest Airways Company. New air labels, not previously in the collection, were given by Le Roy V. Coburn. Eight aeronautical uniform buttons were received from R. Scully of Montreal.

Jacques Cornillon gave 13 issues of *Technique et Science Aeronautiques*, publication of L'Association des Anciens Élèves de l'École Nationale Supérieure de l'Aéronautique, from its beginning in 1943 to No. 3, 1945. Technical translations and aeronautical house organs were received from the Cornell Aeronautical Laboratory through the courtesy of Elma T. Evans. His book *New York: An American City, 1783–1803*, was given by Dr. Sidney E. Pomerantz. Technical books by Klemin, Warner, Munk, Diehl, Stewart, Glauert, and Hotchkiss were received from Ward F. Davidson.

News of Corporate Members

American Airlines System plans to install JATO equipment on all planes of its Contract Air Cargo Division. JATO units will be installed on the seven DC-3's of American's present contract cargo fleet and on four more airplanes scheduled for early delivery. Air-line officials stated that elimination of intermediate refueling stops and the ability to fly longer distances would increase operation reliability and reduce costs.

Chandler-Evans Corporation merged with its parent company, the Niles-Bement-Pond Company of West Hartford, Conn., on January 1. It will be known as the Chandler-Evans Division of the Niles-Bement-Pond Company. This change in the corporate structure will in no way affect the operation of the business, which is now located in its entirety at the plant of the parent company in West Hartford. M. E. Chandler, Associate Fellow of the Institute and former Vice-President in Charge of Engineering, is now Manager of Engineering and Research for the Division.

M. E. Chandler.

Since the end of the war this Division has devoted its efforts primarily to development work in the field of fuel-control mechanisms for aircraft, with special emphasis on such devices as are applicable to jet propulsion types.

El Segundo Engineering Department of Douglas Aircraft Company, Inc., has transferred its entire unit from the 13-acre site on Manchester at Aviation Blvd., Los Angeles, to the main El Segundo Plant at Imperial Blvd. and Lapham St., 3 miles away. The transfer was made to consolidate key functions. Although the new engineering quarters will be reduced 40 per cent in area, a closer relationship between the engineers and the production line will be gained by

centralizing Douglas operations. In the new location Engineering, Planning, Tooling, Matériel, Test Laboratories, Model Shop, and Experimental Shop Sections will occupy the single North Building of El Segundo's main plant.

Several hundred Douglas engineers are again occupying quarters in the main El Segundo Plant from which they moved in September, 1942, to decentralize facilities as a precaution against possible enemy attack at that time.

The plant is now operating at capacity to fulfill a $50,000,000 contract for carrier-based AD-1 Skyraiders, the Navy's newest attack-type airplane. In addition, several high-speed airplanes of confidential nature are being built to conduct research in flight at speeds approaching sound.

Pennsylvania Central Airlines Corporation has formed an International Contract Division to fly seven round trips to Europe each week for the Army Air Transport Command on a contractual basis. The route, from Washington, D.C., to Frankfurt, Germany (by way of Bermuda, the Azores, and Paris), will be serviced by four-engined equipment owned by the Army. All flight crews, supervisory ground personnel, maintenance crews, and facilities will be furnished by P.C.A. The contract will run at least until the middle of 1947.

Republic Aviation Corporation has been awarded new military aircraft orders totaling more than $25,000,000 by the Air Matériel Command, A.A.F. The bulk of the new order is for an undisclosed additional number of P-84 Thunderjets, the first American jet fighter to exceed 600 m.p.h. as standard performance. Assembly-line production of these aircraft is now under way at the Republic plant at Farmingdale, L.I. Cumulative orders call for production of more than 500 of the new jet fighters.

United Air Lines terminated more than 4 years of operation across the Pacific for the Air Transport Command on January 16. This action will mark completion of the company's extensive war job, begun in 1942, in which United contributed its facilities and experience in carrying out widespread contract operations for the Army and Navy.

In its Pacific operations alone, United's crews logged more than 50,000,000 miles, transported approximately 156,000 military passengers, and carried over 8,600 tons of cargo and 9,200 tons of mail.

Currently, United, together with its subcontractors Pacific Overseas Airways and Transocean Air Lines, is flying two daily round trips between San Francisco and Tokyo, in addition to two daily round trips between San Francisco and Honolulu. The 1,187 United employees in Pacific operations, including 30 flight crews, will be assigned to the company's expanding commercial operations.

Western Air Lines, Inc., received the Tenth Annual Maintenance Award given jointly by *Aviation* and *Air Transport* magazines, McGraw-Hill publications, in recognition of its outstanding record for good maintenance operation.

The plaque, won by Western Air Lines over a field of 14 air lines flying up to 10,000,000 plane-miles per year, was presented at an aviation industry luncheon in Los Angeles. In announcing the award, it was pointed out that Western has contributed constantly to improved maintenance in air transportation through two decades of operation. Many repair and overhaul techniques developed by the air line have become standard practice in the industry.

Willys-Overland Motors, Inc., Aircraft Research and Development Division, recently moved from Toledo to Los Angeles, has become a Corporate Member of the Institute.

Postwar plans for the Division call for aggressive participation in development of military aircraft and in related fields, with full backing of Willys-Overland resources. The Division is currently working on a supersonic project for the Navy's Bureau of Aeronautics. Willys-Overland was one of the nation's largest producers of robot bombs during the war and is responsible for a significant number of advanced weapons of confidential nature.

A nucleus of specialists in the fields of preliminary design, aerodynamics, propulsion, guidance and control, structures, and launching has been assembled and is being enlarged as rapidly as possible. The Division is now located in the Willys-Overland West Coast Assembly Plant in Los Angeles.

Dr. Norton B. Moore.

Dr. Norton B. Moore, Associate Fellow of the Institute, has been named Director of Engineering of the Division, with Albert C. Reed (M.I.A.S.) as Assistant Director.

Wright Aeronautical Corporation has acquired, under a long-term agreement, the exclusive rights in this country to certain gas-turbine system applications and patents in the aircraft field of the Atkiegolaget Ljungstroms Angturbin (Ljungstroms Steam Turbine Company) of Sweden. The contract covers world-wide sales rights and involves a number of patents already issued and a series of patent applications now on file in the United States Patent Office, additional inventions that the Ljungstroms firm may make or acquire during the life of the agreement, and technical cooperation in matters relating to the design of aircraft power plants in the gas-turbine field.

Sections and Branches

Cleveland Section

By Richard C. Gazley
Secretary-Treasurer

An interesting technical meeting was held December 19 at the Cleveland Engineering Club. The speakers were George F. Topinka, Project Engineer for United Air Lines, Inc., and Don Stuart, Director of Technical Development Services for the Civil Aeronautics Administration.

The general subject of both talks was "aircraft landing aids." Mr. Topinka described the work that has been done at Arcata, Calif., which has been set up as a landing-aid research station. Mr. Stuart discussed the specifications for landing aids which have been adopted by international agreement and described the equipment now available and under development which meets these specifications. Both talks were illustrated with slides.

New York Section

By Otto E. Kirchner, *Secretary*

The New York Section was most fortunate in engaging two outstanding authorities in their fields to speak on December 11.

Dr. Sweeney, an expert on pressurization and high-altitude flying, outlined the hazards of explosive decompression as experienced by Army fliers. He described the fundamental losses that are involved in rapid pressure changes. This talk was followed by a motion and sound picture on experiments that had been carried out by the aeronautical laboratory at Wright Field on the sudden explosive decompression effect on human beings. The rates of pressure change determined from these tests are considerably higher than any that might be experienced in routine commercial air transportation.

Dr. Sweeney's talk was followed by a paper by Lieutenant Ames on the newest military development of a pilot cockpit ejection seat. The high speeds of modern military aircraft create definite hazards in "bailing out" procedures. A more rapid and sure method of evacuation is needed. The ejection seat allows the pilot to be projected as a bullet from the aircraft. When his forward speed has been sufficiently reduced, he may operate the parachute with safety. This talk was followed up by a motion picture showing the initial tests and test equipment involving the first human evacuation by the evacuation seat ever performed. This film was dramatic and showed in detail the pilot's actions in completing this maneuver.

Each talk was followed by a period of interesting discussion.

Philadelphia Section

By Seymour Gottlieb, *Secretary*

The Philadelphia Section held a dinner and meeting on January 7, 1947, at the Engineers Club of Philadelphia. Carl De Ganahl presided as Chairman, and 52 members and guests attended.

The speaker for the meeting was Arthur N. Tifford, Aviation Gas Turbine Division of the Westinghouse Electric Corporation, and a Member of the Institute. Mr. Tifford obtained his B.E.E. degree *cum laude* from C.C.N.Y. in 1938 and did a year's Graduate work at M.I.T. He then joined the Langley Memorial Aeronautical Laboratory, N.A.C.A., where he conducted an experimental and theoretical program of research into heat transfer and fluid flow. About half a dozen N.A.C.A. reports cover the results of these studies.

After leaving the N.A.C.A. in 1942, the speaker spent 3 years doing aerodynamic and heat transfer work for several aircraft firms and participated in some phases of the design of the identical Cooperative Wind Tunnels at the California Institute of Technology and at the Cornell Aeronautical Research Laboratory. He also had published several papers having to do with heat transfer and thermal boundary layer effects in low- and high-speed flow fields.

Mr. Tifford joined the Aviation Gas Turbine Division of the Westinghouse Electric Corporation in 1945. His latest paper, "Some Prandtl Number Effects on Heat Transfer," is scheduled to appear shortly in the *Proceedings of the Sixth International Congress of Applied Mechanics.*

Mr. Tifford's paper was entitled "The Application of Gas Turbines to Aircraft." It gave a general comparison of the basic differences between gas turbines and reciprocating engines as applied to aircraft, including four main topics: aerodynamics, weight, fuel consumption, and power output. The advantages of the gas turbine were shown to be: use of smaller nacelles; negligible cooling required; high-speed efficiency, light weight per pound of thrust; and relatively constant thrust with higher output efficiencies at high speeds and high altitudes. Although the specific fuel consumption for the gas turbine is generally poorer than for the reciprocating engine, the consumption does improve with altitude and speed. Low-speed inefficiency is a disadvantage of the gas turbine.

A quantitative evaluation of the performance of aircraft power plants was presented. The resulting generalization of Brequet's range formula clearly shows the range benefits to be derived by turbopowered aircraft from cruising at high altitudes, from flying at high indicated cruising speeds, and from use of small wing aspect ratios. Cruising speeds for turbojet airplanes may be from 25 to 58 per cent higher than for reciprocating engine aircraft and aspect ratios may be 33 per cent smaller. For airplanes with design speeds over 550 m.p.h., the turbojet airplane shows much longer range and similar take-off run in comparison with reciprocating engine types. For design speeds between 350 and 550 m.p.h. the turbopropeller airplane gives better range characteristics for equivalent take-off runs than the reciprocating engine types.

Arthur N. Tifford.

A discussion was presented of the benefits to be derived from derating turbojet engines so as to obtain lower specific fuel consumption and still retain good take-off, climb, and high-speed characteristics. The use of an adjustable tail area for "de-rating" purposes is indicated.

An enthusiastic question-and-discussion period was conducted by Mr. Tifford at the close of his paper. Subjects discussed were the use of the turbojet in new transports, the future of the propeller drive for essentially high-pay-load aircraft, and the possibilities of the development of the ducted fan for propulsion.

The meeting was concluded with the showing of two motion pictures—*Loran Basic Principles* and *Attitude Gyro.*

Aeronautical University

On December 3 a technical meeting of the Student Branch was held at the Masonic Temple in Chicago. "Elementary Considerations of Gas Turbines" was the topic of a paper presented by Fred S. Kramer, Associate Fellow of the Institute and Technical Consultant from Wright Field.

Catholic University of America

The Catholic University Student Branch held its regular monthly meeting on December 11 in the Aeronautical Laboratory of the University. The meeting was highlighted by an interesting talk by Dr. Max M. Munk on the development of shock waves in supersonic flight. He presented the problems that will face the designer of supersonic aircraft and illustrated these problems with special slides obtained from German research centers. Two German scientists, who are acquainted with the development of V-2 missiles in Germany and who have been brought to this country by the Government to aid in the research of supersonic flight, were special guests at the meeting. Their names are restricted by the Navy Department. Two films were shown: one dealt with superchargers; the other, with condensation trails. Refreshments were served after the meeting to the 22 students and guests.

Ohio State University

On November 5, 1946, 70 Ohio State University students organized an I.A.S. Student Branch. The purpose, aims, and benefits of the organization were explained and applications for membership were accepted. The following officers were elected temporarily: Chairman, Lloyd Yates; Secretary, Nelson Kemp; Treasurer, Fred Tietzel; and Honorary Chairman, E. L. Miller. Dues were set at $2.00 a year. At this first meeting R. W. Holmes, Curtiss-Wright Corporation, presented a paper, "Remarks to Aeronautical Engineering Students." The meeting was closed following a documentary film, *The History of Naval Aviation.*

One-hundred students attended a joint business and technical meeting on November 19. "Some Elementary Considerations of Conditions Within a Shock Wave" was the title of a paper delivered by Lt. Knox T. Millsaps, Army Air Forces, OSU Wright Field Graduate Center. This speech was followed by a Curtiss-Wright film describing production of the P-40. Lieutenant Millsaps' paper will be published soon in the *Proceedings of The Royal Aeronautical Society.* The Chairman announced that one-half page in the University Yearbook, *Makio of 1947*, had been purchased by the Branch.

At the meeting on December 3 By-Laws were submitted by the Executive Committee. They were discussed and approved by the members. Temporary officers were then elected permanently, with the addition of a Vice-Chairman, Guy E. Edington. The business session was ended by the appointment of a Program Committee Chairman, Ray Link. Two films were shown: *Jet Propulsion* and *Cyclone Combustion.*

University of Oklahoma

On December 11, members of the Student Branch held a meeting in the Engineering Building. Edward Ham, Chairman, presided over the business session. He then turned the meeting over to Kendal Garms, who reported on the new Beechcraft Bonanza.

On December 18, 32 members attended a technical session in the Union Building, held jointly with the Tau Omega aeronautical fraternity. A general discussion forum followed two technical films—*Aircraft Production Methods* and *Static Tests of Airplanes.*

Polytechnic Institute of Brooklyn

At a Student Branch meeting on November 12 the following officers were elected: Chairman, Glenford J. Wennagel; Vice-Chairman, Carl Grubin; Secretary, Ann E. Gunsolus; and Treasurer, Leonard Lipkin. Following the elections, Paul A. Libby, Instructor in the Aeronautical Engineering Department, discussed the mechanics of aircraft vibration. He gave emphasis to the physical aspects of vibration problems with a description of the phenomena of flutter, divergence, aileron reversal, and tail-buffeting.

On December 12, Prof. N. J. Hoff, Faculty Adviser of the Branch and a Professor in the Aeronautical Engineering Department, outlined the history of the Institute and described the requirements and advantages of student membership. A film, *Power by Wright*, was then shown.

Purdue University

"What the Aeronautical Engineer May Expect in Industry" was the subject of a Purdue University Student Branch round-table discussion on November 19. The discussion was broadcast over radio station WBAA at 8:00 p.m. The speakers contributing to the discussion were: Professor Rosenberg and Messrs. Islinger, Flatau, Hunt, Corden, Perisho, Cleveland, Zimney, and Whinery.

Spartan College

On November 1 the Spartan College Student Branch held a business meeting for the election of a new Chairman. Donald B. Maddocks was selected to succeed Robert Perkins, who is transferring to Tulsa University.

At the meeting on November 14 a new social committee was appointed to arrange for the coming graduation banquet. Each member was asked to contribute two constructive ideas for the improvement of the organization. The relative merits of two personal planes were discussed, the Republic Seabee and the Beechcraft Bonanza.

Arrangements for the graduation banquet were completed at a meeting on December 2. All members of the Engineering College were invited to this meeting to hear Prof. Leon P. Lipsick deliver a paper on "Supersonics."

On December 7, the graduation banquet was held at the Sayer's Supper Club. Dinner speakers were Tom Glasser and Charles Robinson. Gifts were presented to the graduating members in appreciation of their loyal efforts during their enrollment at Spartan. John E. Craig was elected Treasurer at a meeting following the banquet.

University of Tulsa

The University of Tulsa Student Branch held a joint business and technical meeting on December 12. O. L. Deardorff, Jr., was elected Acting Secretary-Treasurer. Plans were made for a Branch picnic or party. It was decided that the funds for the entertainment would be obtained by assessment. Following the business session, an Army Meteorological Training film was shown.

Wayne University

Officers were elected at the Wayne University Student Branch meeting on November 8. The following took office: Chairman, Albert Rosenblum; Vice-Chairman, Marvin Abramovitz; Secretary, David Greenberg; Treasurer, Arthur R. Pearce.

Speakers for the evening were Robert Dale, Cass Technical High School, and Fred Ross, Development Engineer for Bendix Research Division. The topic for both speeches was "Important Factors of Light Aircraft Design."

News of Members

Stewart P. Adams, Senior Liaison Engineer, The Glenn L. Martin Company, was formerly Liaison Engineer with Fairchild Aircraft Division, Fairchild Engine and Airplane Corporation.

Ralph S. Barnaby, who recently retired from the Navy as a Captain, is now Head of the Pilotless Aircraft Research & Development Section of The Franklin Institute.

Ernest L. Bass, I.A.S. Associate Fellow and Associate Fellow of The Royal Aeronautical Society, has been named Chief Engineer of Shell Aviation Department of the Shell Petroleum Company in England.

Charles R. Beek is now an Aeronautical-Project Engineer at the David Taylor Model Testing Basin, U.S. Navy, in Washington, D.C.

Leon J. Berman, who before the war was Staff Engineer at Avion, Inc., is now a Research Engineer in the Aircraft Research and Development Division of Willys-Overland Motors, Inc.

E. J. Boland has recently been appointed Manager of Sales for the Meter and Instrument Division of General Electric's Apparatus Department. Mr. Boland, a native of Denmark and an Engineering Graduate of Aarhus Technical Institute there, came to General Electric in 1926. He has been associated with both meter and instrument work since joining the company. He was appointed Assistant Manager of Sales of the Instrument Section early in 1945.

C. K. Bransford, former U.S. Navy Lieutenant, is now a Research Engineer at Shell Oil Company, Inc.

W. O. Breuhaus, former Aerodynamics Designer at the Chance Vought Aircraft Division of United Aircraft Corporation, is now an Engineer in the Flight Research Department, Cornell Aeronautical Laboratory.

Robert C. Brucato, a Draftsman, Senior Grade, at the Chance Vought Aircraft Division of United Aircraft Corporation prior to Navy service, has returned to the company as a Senior Aeronautical Designer.

John A. Burt, formerly with the U.S. Navy, is now a Stress Analyst in the Helicopter Division of Bell Aircraft Corporation.

Robert L. Caswell, former Structures Officer in the U.S. Navy, is now a Layout Draftsman in the Fuselage Group, El Segundo Division, Douglas Aircraft Company, Inc.

Shou Pao Chang has resigned his position as Training Engineer at Consolidated Vultee Aircraft Corporation and is now a Test Engineer for the Gloster Aircraft Company in England.

William M. Chase, formerly with the U.S. Navy, is a Flight Test Engineer for Grumman Aircraft Engineering Corporation.

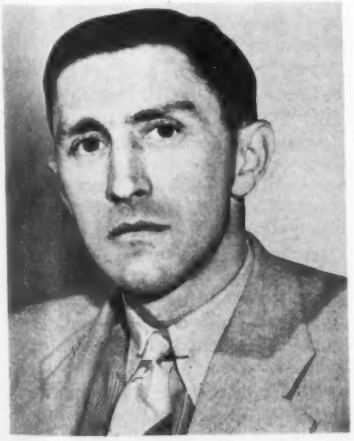
Ou-Wen Chen, former Flight Test Engineer at Republic Aviation Corporation, is now Assistant Manager of the Industrial Development Division of the Far East Development Corporation, Ltd.

Lawrence B. Clifford, formerly with the R.C.A.F., is now a Class "A" Designer at Canadair, Ltd., in Canada.

Henry D. Dankenbring has been advanced from the position of Design Draftsman to Engineer in The Glenn L. Martin Company.

Julius L. Dimond, now a Structures Engineer at Republic Aviation Corporation, was formerly Chief Draftsman and Project Engineer at the Vidal Aircraft Research Corporation.

Julius J. Domonkos, former Manager of Bell Aircraft Corporation's Burlington Division, has been elected a Vice-President of the Corporation. Mr. Domonkos, who has been active in the aircraft industry since 1923, has been with Bell since June, 1936. Prior to this position he was employed by The Glenn L. Martin Company.



Julius J. Domonkos.

James R. Downey is Chief Engineer and Purchasing Agent for the Airport Supply Corporation. He has been affiliated with the Bureau of Aeronautics, U.S. Navy.

Robert A. Dubois, former Assistant Chief of the U.S. Charts Section of the Department of Commerce, is now Chief of the Air Navigation Facilities Section of the U.S. Coast & Geodetic Survey.

Eugene J. Dugan, Jr., is now a Structures Test Engineer at Beech Aircraft Corporation. He was previously a Structures Engineer at Aeronca Aircraft Corporation.

Neil E. Dunkelberger, former Junior Engineer, Research Department, Curtiss-Wright Corporation, is now a Flight Test Engineer in the Fairchild Aircraft Division, Fairchild Engine and Airplane Corporation.

Edward P. Eales has left his position as Instructor at Iowa State College and is now Research Assistant in the Department of Engineering at the University of Michigan.

John W. Edgerton is now an Advisor on Aviation Securities for the American Automobile Insurance Company. He was formerly affiliated with Brown Brothers Harriman & Company.

R. N. Evensen, a Structures Engineer for Aeronca Aircraft Company before serving with the Navy, is now a Detail Engineer at Boeing Aircraft Company.

Arthur M. Fitzpatrick, Jr., has become a partner in the firm of Fitzpatrick-Randall Associates. Preceding his tour of active duty in the U.S. Navy, he was an Associate of John Tjaarda & Associates.

Joseph Flatt is now Chief of the Design Aerodynamics Unit, Aerodynamics Branch, Aircraft Laboratory, at Air Matériel Command, Wright Field.

Alexander H. Flax, before his present position as Assistant Head of the Structures Department at Cornell Aeronautical Laboratory, was Chief of Aerodynamics & Stress Analysis for the Piasecki Helicopter Corporation.

Arnett J. Franchi, Engineering Designer at The Glenn L. Martin Company, was formerly affiliated with Consolidated Vultee Aircraft Corporation.

Ralph Friedman, former Layout Man for Consolidated Vultee Aircraft Corporation, is an Engineering Designer at Republic Aviation Corporation.

James A. Graham, Power Plant Engineer at Matson Aviation Maintenance Company Airline Engineering, Matson-Air Transport Division, was formerly associated with Consolidated Vultee Aircraft Corporation as a Field Service Engineer.

Robert E. Gross, President of Lockheed Aircraft Corporation of Canada, Ltd., has been appointed a Director of the Security-First National Bank of Los Angeles.

Joseph H. Hafkenschiel is now Assistant Instructor in the Department of Pharmacology at the University of Pennsylvania Medical School.

Paul A. Hartline, until recently a Major Detail Draftsman for Republic Aviation Corporation, is now a Project Engineer in the Equipment Group of Trans World Airline, Inc.

George T. Hayes, former Lieutenant Commander, U.S. Navy, is employed as a Project Engineer for American Overseas Airlines, Inc.

Richard D. Hiscocks is a Design Engineer at The de Havilland Aircraft of Canada, Ltd. Prior to his present position, he was Head of Aircraft Structures Section in the National Research Council.

William S. Homes, who before his service with the Navy was an Engineer for Curtiss-Wright Corporation, is at present a Layout Draftsman at McDonnell Aircraft Corporation.

R. S. Huested, former Administrative Assistant to the General Manager of the Wright Aeronautical Corporation, is associated with the Curtiss-Wright Corporation Export Sales Division.

Lyman C. Josephs, III, Administrative Assistant to the Senior Project Engineer, Chance Vought Aircraft Division, United Aircraft Corporation, was formerly a Project Officer in the Fighter Design Branch of the Bureau of Aeronautics, Navy Department.

Edward S. Kaplan has returned to the Aeronautical University of Chicago as a student after his separation from the Army Air Forces. Before the war he was an Aeronautical Draftsman at Consolidated Vultee Aircraft Corporation.

Alexander Kartveli, a Fellow of the Institute and one of the world's best-known designers of high-speed aircraft, has been elected to the Board of Directors of Republic Aviation Corporation. Mr. Kartveli designed the P-47 Thunderbolt and the P-84 Thunderjet, a jet-propelled plane that holds the American speed record of 611 m.p.h. He also designed the XF-12, a four-engined photoreconnaissance plane, the commercial version of which will be the 400-m.p.h. Republic Rainbow. Mr. Kartveli has been Vice-President and Chief Engineer of the Republic Aviation Corporation since it was formed in 1939. Before that he was Assistant Chief Engineer for the Seversky Aircraft Corporation.

George E. Kellough, Jr., is now connected with the Equipment Design Section of the Engineering Department of the Curtiss-Wright Corporation. Before the war he was a Junior Engineer in the Airplane Division of the company.

Harold S. King, who was a Flight Research Engineer at Bell Aircraft Corporation prior to Navy service, is now a Helicopter Flight Test Engineer at Bell.

Myer Klein, Layout Engineer at Republic Aviation Corporation, was formerly a Design Engineer at Taylor-Craft Aviation Corporation.

Joseph Korn, has been assigned to the Performance Group in the Aerodynamics Department, Curtiss-Wright Corporation. He was formerly a P-1 Aeronautical Engineer, Air Matériel Command, Wright Field.

Charles E. Kroupa is now an Aerodynamicist at Grumman Aircraft Engineering Corporation.

Haig Kurkjian, Flight Test Engineer at Piasecki Helicopter Corporation, was formerly an Electrical Engineer at Kellett Aircraft Corporation.

Emory S. Land, President of the Airline Union Terminal Association, has been re-elected President of the Air Transport Association.

Oscar T. Larson, Assistant to the Vice-President—Operations, United Air Lines, Inc., has been re-elected to the Board of Directors of the Air Transport Association.

Dean M. Lewis, Design Engineer at the Electrical Group of Curtiss-Wright Corporation's Columbus Plant, was affiliated with the company as a Junior Engineer in the Airplane Division prior to service in the Navy.

Chao Peh Li, formerly connected with Consolidated Vultee Aircraft Corporation and later a Captain in the Chinese Air Force, is now an Engineer at Gloster Aircraft Company, England.

Maurice E. Long, at present an Aeronautical Engineer at David Taylor Model Testing Basin, U.S. Navy, Washington, D.C., was formerly affiliated with the Daniel Guggenheim Airship Institute, University of Akron, as a Research Engineer.

Samuel J. Loring, previously a Research Engineer at Chance Vought Aircraft Division, United Aircraft Corporation, is now an Independent Engineering Consultant.

Harry Louis has been promoted to Chief Aeronautical Engineer of Canadian Pacific Air Lines, Ltd. Prior to this he was a District Engineer.

Allan L. Lubin has been advanced from the position of Junior Weight Engineer to Structures Design Engineer at Chance Vought Aircraft Division of United Aircraft Corporation.

John W. Mazur, Helicopter Project Engineer, Flight Test Division, U.S. Naval Air Test Center, Patuxent River, Md., was formerly affiliated with Raymond Engineering Laboratory, Inc.

Thomas G. McClelland, recently a Flight Test Project Pilot, Naval Air Test Center, Patuxent River, Md., is now Experimental Test Pilot at the Chance Vought Aircraft Division, United Aircraft Corporation.

Roland L. McFarland is now a Consultant to the Guided Missile Group, Raytheon Manufacturing Company.

Donald N. Meyers, Chief of Rotor Design at Piasecki Helicopter Corporation, was formerly affiliated with P-V Engineering Forum, Inc., as a Mechanical Design Engineer.

Ralph E. Middleton has become a partner in the Variety Development & Engineering Company. He was formerly Vice-President in Charge of Engineering and General Manager of the Hydraulic Division of Aireon Manufacturing Corporation.

Raymond E. Monahan is a Stress Analyst at the Curtiss-Wright Corporation.

Albert W. Mooney, now a partner in Mooney Aircraft Company, was formerly Vice-President and Chief Engineer of the Culver Aircraft Corporation.

Robert L. Moore is affiliated with the Atlantic Division of Pan American World Airways System as Staff Maintenance Engineer. He was a Senior Draftsman at Lockheed Aircraft Corporation and later a Stress Analyst.

Corliss C. Moseley, President of Aircraft Industries Corporation, Cal-Aero Corporation, and Polaris Flight Academy, has been named a Member of the Board of Directors of the Merchants and Manufacturers Association.

Merle C. Mueller is now an Engineering Draftsman at the Luscombe Airplane Corporation.

James L. Murray, Engineer-Test Pilot at Ames Aeronautical Laboratory, N.A.C.A., was formerly a Major in the Army Air Forces, Supervising Maintenance.

Raymond T. Patterson, Project Engineer for Supersonic Wind Tunnels at the David Taylor Model Testing Basin, U.S. Navy, was formerly a Research Analyst at Lockheed Aircraft Corporation.

William A. Patterson, President of the United Air Lines Transport Corporation, has been re-elected to the Board of Directors of the Air Transport Association.

Mundy I. Peale, former Vice-President and General Manager of Republic Aviation Corporation, has been elected President of the Corporation.

C. C. Pearson.

C. C. Pearson has been appointed General Manager of the Curtiss-Wright Corporation, Airplane Division, and will make his headquarters at the Columbus, Ohio, plant. Mr. Pearson had been with the Douglas Aircraft Company, Inc., for 16 years. Recently, he served as Eastern Representative, with offices in New York. During the war he was Manager of the Oklahoma Plant.

L. Welch Pogue, former Chairman of the Civil Aeronautics Board, has established an office for the practice of law at 1025 Connecticut Ave., Washington 6, D.C. The firm name is Pogue & Neal.

Tex M. Raisen, Product Engineer at K-D Lamp Company's Noma Electric Division, was formerly Aircraft Process Engineer for Delco Products Division of the General Motors Company, Inc.

Abner Rasumoff, Project Stress Analyst at Kellett Aircraft Corporation, was formerly connected with Kaiser Fleetwings, Inc.

Arthur E. Raymond, Vice-President in Charge of Engineering at Douglas Aircraft Company, Inc., and 1946 President of the Institute, has been reappointed to the National Advisory Committee for Aeronautics for a 5-year term by the President of the United States.

Leo A. Riley is now an Aeronautical Engineer, Chance Vought Aircraft Division, United Aircraft Corporation.

Berkeley C. Roden is at present employed as a Group Leader in the Fuselage & Empennage Structures Design Office, Canadair, Ltd., in Canada.

Eugene Rohman, recently of Lockheed Aircraft Company's Aerodynamics Department, is a Sales Engineer in the Instrument Division of the Thomas A. Edison Industries.

Frank D. St. Hilaire is at present Aviation Technical Representative of the Foreign Aviation Division of The Texas Company. He was previously employed as Service Engineer in charge of service for the Electro-Mechanical Division of Lear, Inc.

Ralph D. Salisbury, Jr., former Draftsman for North American Aircraft, Inc., is now an Aeronautical Engineer at the Ames Aeronautical Laboratory, N.A.C.A.

Arthur H. Samet is affiliated with Republic Aviation Corporation as a Research Engineer. Previously he had been a Stress Analyst in the Structures Department of Aeronca Aircraft Corporation.

Serge N. Sanburoff is now located at Johns Hopkins University, employed in Mechanical Design in the Applied Physics Laboratory. Prior to this appointment he was an Aircraft Tool Designer for the Engineering & Research Corporation.

Charles J. Schell, Jr., Senior Draftsman at The Glenn L. Martin Company, was an Engineering Instructor at the Casey Jones School of Aeronautics prior to his service in the Army Air Forces.

Edwin F. Schoch is a Flight Test Engineer and Pilot at McDonnell Aircraft Corporation.

Hermann Schoenen has been promoted to the position of Research Laboratory Analyst, Class "A," at Boeing Aircraft Company. He was previously a Preliminary Design Engineer.

Morton Shafir is now an Aeronautical Engineer at the Langley Memorial Aeronautical Laboratory, N.A.C.A.

Polin Shen is a Trainee Engineer at Gloster Aircraft Company, Ltd., in England.

Carlton E. Sisler, Jr., is employed as a Designer for Douglas Aircraft Company, Inc. Before the war he was a Detail Draftsman at Douglas.

Eric Skelton, former Air Engineer Officer in the Royal Navy, is now Assistant Experimental Superintendent at Airspeed Ltd., in England.

Lawrence N. Smithline, former Assistant Executive Engineer-Manager of the Plastics Division, York Research Corporation, is now Chief Engineer at Commonwealth Aircraft, Inc.

Joseph C. Soraghan, Jr., new Chief of Research for Percival Aviation Corporation, was recently engaged as Group Structural Engineer at Fairchild Engine and Airplane Corporation.

Athelstan F. Spilhaus, Director of Research for the College of Engineering at New York University, has been awarded the Legion of Merit by the War Department in recognition of his research and aid in the development of meteorological equipment during the war. Serving as a field projection liaison officer with the rank of Lieutenant Colonel in the Air Corps, Professor Spilhaus saw active service in many theatres of action from February, 1943, to January, 1946.

Basil Staros, prior to his present position as Research Engineer in the Jet Propulsion Laboratory at California Institute of Technology, was Junior Aeronautical Engineer at Matériel Division, U.S. Army Air Forces, Wright Field.

William B. Stephenson is now Assistant Professor of the Aeronautical Engineering Department at Louisiana State University.

Leslie C. Stevens, Rear Admiral, U.S. Navy, Assistant Chief of the Bureau of Aeronautics in Charge of Research, Development, and Engineering, has been appointed to the main Committee of the National Advisory Committee for Aeronautics.

Marvin R. Sward is now a Detail Engineer at Boeing Aircraft Company.

Samuel Taubman, Stress Analyst at Lockheed Aircraft Corporation before the war, has returned to the company and is now a Research Engineer.

Phrixos J. Theodorides, former Professor of Applied Mechanics and Aerodynamics at Athens University of Engineering Science, is at present a visiting lecturer on Aeronautical Engineering for Harvard University.

Cyril C. Thompson, former Vice President of United Air Lines, Inc., has been appointed Special Representative for Air Transport by the Santa Fe Railway System. His headquarters will be in Chicago. Identified with air transportation since 1926, Mr. Thompson was a Director of the Air Lines War Training Institute, as well as United's liaison officer during Army air-cargo expansion during the war.

John H. Towers, Admiral, U.S. Navy, Commander in Chief of the Pacific Fleet, will be appointed to head a Navy general board, the Secretary of Navy's Senior Advisory Group on planning. Admiral Towers is retired from active duty.

Juan T. Trippe, President of Pan American World Airways System, was elected to the Board of Directors of the Air Transport Association at a meeting of the directors and members held in Washington.

Robert W. Truitt is a Professor of Aeronautical Engineering at the North Carolina State College of the University of North Carolina.

Chin-Tao Tsao, former Aeronautical Engineer at Consolidated Vultee Aircraft Corporation, is presently employed in an engineering capacity at Gloster Aircraft Company in England.

John Upton, Jr., is now an Aerodynamicist at Chance Vought Aircraft Division of United Aircraft Corporation.

F. N. Van Branteghem is in the Structures Section of the Engineering Department of Curtiss-Wright Corporation. He was formerly a Junior Engineer at Boeing Aircraft Company.

Edwin A. Warren, The Glenn L. Martin Company's Cargo Sales Manager, was formerly Manager of Military Contracts at Curtiss-Wright.

Ralph E. Wendt is now a Senior Aerodynamicist at Western Air Lines, Inc. Before the war he was a Research Aerodynamicist at Bell Aircraft Corporation.

Joseph G. Wetzel has been appointed Assistant to the General Manager in Charge of Public Relations and special assignments of Wright Aeronautical Corporation. Mr. Wetzel was formerly Manager of Administrative and Publications Division of the company.

Wayne Wiesner has joined United Helicopters, Inc., of Palo Alto, Calif., in the capacity of Assistant Chief Engineer. Mr. Wiesner was the holder of the 1941 Cierva Fellowship in Rotary-Wing Aircraft at New York University. Since his graduation, he has been continually engaged in rotary wing engineering at the Kellett Aircraft Corporation.

John M. Wild, former Mechanical Designer at Associated Electric Laboratories, Inc., is now an Associate Professor of Aeronautical Engineering at Cornell University.

Eugene E. Wilson, who recently resigned as Vice-Chairman of the Board of United Aircraft Corporation, has also resigned his position as Director of the Corporation.

Justin H. Wirtz, Design Specialist at Goodyear Aircraft Corporation, was formerly an Aeronautical Engineer at Consolidated Vultee Aircraft Corporation.

Yih Chang Yang, Jr., is now an instructor at the Virginia Polytechnic Institute.

The primary purpose of these columns is to record the current activities of Institute members and provide information that is of interest and value to other members.

All members are invited (in fact, urged) to send in releases or letters promptly informing the editors of any changes in positions, promotions, achievements, or other news items.

Members Elected

The following applicants for membership or applicants for change of previous grades have been admitted since the publication of the list in the last issue of the REVIEW.

Transferred to Associate Fellow Grade

Del Mar, Bruce Eugene, B.S. in M.E.; Preliminary Design Project Engineer, Douglas Aircraft Co., Inc.

Elected to MEMBER Grade

Anchutin, Andrew, Ae.E.; Design Engineer, Jet Helicopter Corp.

Bauer, Harold Ernest, A.A.; Engineering Designer, Douglas Aircraft Co., Inc.

Bradley, Follett, B.S.; Asst. to the President, Sperry Gyroscope Co., Inc.

Chambers, Lee Clarence, Maintenance Design Engineer, Lockheed Aircraft Corp.

Cooper, George Emery, B.S. in Mining Engineering; Engineer Test Pilot, Ames Aero. Lab., N.A.C.A.

Eisenberg, Phillip, B.S. in C.E.; Physicist-Supervisor "Flow Study Section," Hydromechanics Div., David W. Taylor Model Basin, Navy Dept.

Foley, Dennis Langley, Lt. Comdr., Chief Air Technical Officer, Royal Canadian Navy.

Goldberg, Robert, M.S. in Ae.E.; Stress Analyst, Republic Aviation Corp.

Gdumundson, Sven Erik, C.E.; Section Engineer, The Aeronautical Research Institute of Sweden.

Haley, James Aloysius, M.S. in Ae.E.; Capt. (Division Director), U.S. Navy.

Hammil, John Phillip, Jr., B.S.; Stress Engineer, Douglas Aircraft Co., Inc.

Holland, Raymond Prunty, Jr., S.B.; Engineering Flight Test Supervisor, Lockheed Aircraft Corp. (on leave).

Hopkins, William Andrew, B.Ch.E.; Lt. Comdr., Aeronautical Engineer, Bureau of Aeronautics, Navy Dept.

Huester, Harry J., Lt. Comdr., Bureau of Aeronautics, U.S. Navy (Wright Field).

Koepnick, Louis Roy, Ae.E.; Director of Base Engineering, Transcontinental & Western Air, Inc.

I.A.S. Meeting Preprints

A limited number of copies of preprints of papers presented at meetings of the Institute are available for distribution, at a charge of 25 cents each to members of the Institute, and 50 cents to nonmembers, to cover handling and mailing charges. The following lists the preprints available from the past five national meetings of the Institute. Preprints may be ordered by number.

Fourteenth Annual Meeting—New York, N.Y., January 29–30–31, 1946

3. The Determination of Airspeed System Errors—Herbert R. Crawford, Chief Flight Test Engineer, Grumman Aircraft Engineering Corporation. 68 pages; 13 illus. (Typewritten and photo-offset.)

4. Trouble Shooting with Vibration Equipment—Harold Vern Hawkins, Vibration Engineer, Bell Aircraft Corporation. 37 pages; 13 illus. (Typewritten and photo-offset.)

5. The Development of a High-Temperature Light-Weight Insulation for Jet Aircraft—Donald Jelinek, Mechanical Research Engineer, North American Aviation, Inc. 26 pages; 22 illus. (Ditto.)

6. Safety Beyond Regulatory Requirements—W. E. Koneczny, Safety Bureau, Civil Aeronautics Board. 25 pages; no illus. (Mimeographed.)

7. Force Measurements by Means of Resistance Wire Strain Gages—W. C. Randels, Aeronautical Engineer, North American Aviation, Inc. 7 pages; 7 illus. (Typewritten and photo-offset.)

8. Considerations in the Design of a Low Cost Wind Tunnel—Howard E. Roberts, Aerodynamics Engineer, Douglas Aircraft Company, Inc. 46 pages; 12 illus. (Typewritten and photo-offset.)

9. Hydraulic Motors and Their Application to Aircraft—James Robinson, Assistant Chief Engineer, Vickers Incorporated. 4 pages; 6 illus. (Vari-typed and photo-offset.)

11. Measurement of Steady and Vibratory Stresses in Aircraft Propellers—E. F. Shelley, Project Engineer, Propeller Division, Curtiss-Wright Corporation. 8 pages; 9 illus. (Mimeographed with ditto illustrations.)

13. The Organization and Utilization of an Aircraft Manufacturer's Air Safety Program—Amos L. Wood, Chief, Accident and Operations Analysis, Boeing Aircraft Company. 9 pages; 14 illus. (Mimeographed with photostats of illustrations.)

Aircraft Propulsion Meeting—Cleveland, Ohio, March 21, 1946

15. Application of Axial Compressors in Aeronautics—Ens. F. J. Gardiner, United States Naval Reserve, Navy Department, Bureau of Aeronautics. 11 pages; 8 illus. (Typewritten and photo-offset.)

Light Aircraft Meeting—Detroit, Mich., June 13–14, 1946

18. Maintenance of Personal Aircraft—George H. Weitz, Chief, Air Frame Section, Non-Scheduled Aircraft Maintenance Division, Civil Aeronautics Administration. 7 pages; no illus. (Mimeographed.)

Annual Summer Meeting—Los Angeles, Calif., July 18–19, 1946

20. Engineering Aspects of the Development of the Rainbow—Alexander Kartveli, Vice-President and Chief Engineer, Republic Aviation Corporation. 68 pages; 61 illus. (Vari-typed and photo-offset.) *Available without charge from Republic Aviation Corporation.*

National Air Transport Meeting—Washington, D.C., October 24, 1946

26. The Application of Microwaves to Instrument Landing of Airplanes—Joseph Lyman, Aircraft Radio Research Engineer, Sperry Gyroscope Company, Inc. 34 pages; 27 illus. (Photo-offset.)

27. Development of International Standards for Airworthiness of Transport Aircraft—Paul A. Puvrez, Expert, Airworthiness Division, Provisional International Civil Aviation Organization (PICAO). 9 pages; no illus. (Photo-offset.)

28. Air Conditioning of Transport Aircraft for Year-Around Comfort in Flight and on the Ground—Bruce E. Del Mar, Mechanical Test Engineer, Santa Monica Engineering Division, Douglas Aircraft Company, Inc. 10 pages; 10 illus. (Photo-offset.)

29. Teleran for Air Navigation and Traffic Control—L. F. Jones, Manager, Research & Development Projects, Radio Corporation of America. 24 pages, bound in covers; 17 illus. (Printed.)

30. Survey of Air Rescue Requirements—Jerome Lederer, Chief Engineer, Aero Insurance Underwriters. 31 pages; 4 illus. (Photo-offset.)

Leadbetter, Robert Thomas, M.B.A.; Installation Engineer — Installations Dept., Propeller Div., Curtiss-Wright Corp.

Leineweber, William Frederick, Jr., B.S. in M.E.; Development Engineer, The Weatherhead Company.

Liming, Roy Aaron, A.B.; Head of Engineering-Lofting Mathematics, North American Aviation, Inc.

Mandelbaum, Herbert, B.S. in C.E.; Supervisor-Weight and Balance Engineering, American Airlines System.

Mardirosian, Martin, B.S. in Ae.E.; Aerodynamicist, Consolidated Vultee Aircraft Corp.

Merrill, Grayson, B.S.; Comdr., Technical Director, U.S. Naval Air Missile Test Center.

Metcalf, Frank Earl, B.S.; Aeronautical Engineer, Equipment Sec., Analysis Div., Intelligence T-2 (Wright Field).

Miller, Edward Luther, B.C.E.; Instructor, Aero. Engineering Dept., Ohio State University.

Napavance, Nicholas, B.Ae.E.; Structures Designer, Douglas Aircraft Co., Inc.

Pauli, Julius Anthony, B.Ae.E.; Engineer Specialist, Fairchild Aircraft Div., Fairchild Engine and Airplane Corp.

Pell, William Hicks, Ph.D.; Project Aerodynamicist, Bell Aircraft Corp.

Prisch, Robert Allerton, B.M.E.; Sales Engineer, Monsanto Chemical Co.

Raftery, Michael Patrick, Aircraft Designer "A," Douglas Aircraft Co., Inc.

Reul, Richard Philip, B.S. in M.E.; Installation Engineer, Wright Aeronautical Corp.

Rossi, Boniface Ernest, M.E.; Materials, Processes and Standards Engineer, Columbia Aircraft Corp.

Schwandt, Gunter William, B.S. in Ae.E.; Engineering Instructor, Aeronautical University, Inc.

Sherwood, Aaron Wiley, M.S.; Professor of Aerodynamics, University of Maryland.

Triani, Howard J., Group Leader, Pilotless Plant Div., Fairchild Engine and Airplane Corp.

Vincent, Harry Lansing, Jr., M.S.; Lt. Comdr., Officer Asst., Aeromechanics Dept., David Taylor Model Basin, U.S. Navy.

Wald, Edwin Prescott, B.S. in C.E.; Aircraft Designer, North American Aviation, Inc.

Weitz, George H., Chief Air Frames, Non Scheduled Aircraft Maintenance Div., C.A.A.

Woolard, Henry Waldo, B.S.E.; Asst. Professor of Aeronautical Engineering, Aeronautical Engineering Dept., West Virginia University.

Ziegenfuss, Richard Harry, B.S.; Supervisor of Engineer Liaison, Fairchild Aircraft Div., Fairchild Engine and Airplane Corp.

Transferred to MEMBER Grade

Nichols, George Edmund, B.S. in Ae.E.; Research Engineer, Structures, Lockheed Aircraft Corp.

Sandler, Donald Harvey, Production Engineer, Pilotless Plane Div., Fairchild Engine and Airplane Corp.

Elected to Associate Member Grade

Barnes, Kenneth Eugene, Departmental Asst. (Technical Contracts), Lockheed Aircraft Corp.

Dawson, Kenneth Coutts, Supervisor of Maintenance Training, Trans-Canada Air Lines (Canada).

LaVene, Clayton Charles, Engineering Div., Employment Manager, Douglas Aircraft Co., Inc.

Elected to Technical Member Grade

Finamore, Odilio Bernard, B.Ae.E.; Jr. Research Engineer, Republic Aviation Corp.

Fournet, Dewey J., Jr., B.S.; Lab. Asst., Instructor, Louisiana State University.

Hayleck, Charles Raymond, Jr., B.S. in M.E.; Instructor, Dept. of Mechanical Engineering, University of Maryland.

Kudravetz, Boris Sawa, Graduate Student, Drexel Institute.

Nozik, Philip, Instrument Technician, Pratt & Whitney Aircraft Div., United Aircraft Corp.

Rathert, George August, Jr., B.S. in Ae.E.; Aero. Engineer, Ames Aero. Lab., N.A.C.A.

Rivello, Robert Matthew, B.S.; Instructor, Dept. of Mechanical Engineering, University of Maryland.

Tuccillo, Anthony Vincent, B.Ae.E.; Layout Draftsman, Piasecki Helicopter Corp.

Vaughan, John Hogan, Flight Test Instrumentation Engineer, North American Aviation, Inc.

Westley, John Roger Lee, Draftsman, Consolidated Vultee Aircraft Corp.

Witt, William Rufus, Jr., B.S.; Instructor in Engineering, Bluefield College.

Yohn, Ernest Merril, Jr., B.S. in Ae.E.; Aeronautical Engineer, Pan American Airways System.

Transferred from Student to Technical Member

Ahlin, Arthur Stewart LeRoy, B.Ae.E.; Head, Procurement & Dissemination Section, Bureau of Aeronautics, Navy Dept.

Gelder, Thomas F., Jr. Engineer, Curtiss-Wright Corp. (Columbus Plant).

Hulslaner, William Leo, B.Sc.; Layout Design Engineer, Hamilton Standard Propellers Div., United Aircraft Corp.

Kriegsmann, Elizabeth Margaret, B.Ae.E.; Aeronautical Engineer, Rotary Wing Branch, Development Unit, Propeller Lab., Wright Field.

Merrick, George Titus, Jr., B.Ae.E.; Production Engineer, American Airlines System.

Murphy, James Sidney, B.S.; Instructor, West Virginia University.

Olsen, Francis George, B.Ae.E.; Graduate Student, University of Michigan.

Preissner, John Henry, B.S.; Engineer, Boeing Aircraft Co.

Samdahl, Russell Heule, B.Ae.E.

Schmidt, Richard Aloysius, B.Ae.E.; Flight Test Performance Engineer, Flight Test Div. (Wright Field).

Slider, Evan Fort, Jr., B.Sc. in Ae.E.; Detail Engineer, Chance Vought Aircraft Div., United Aircraft Corp.

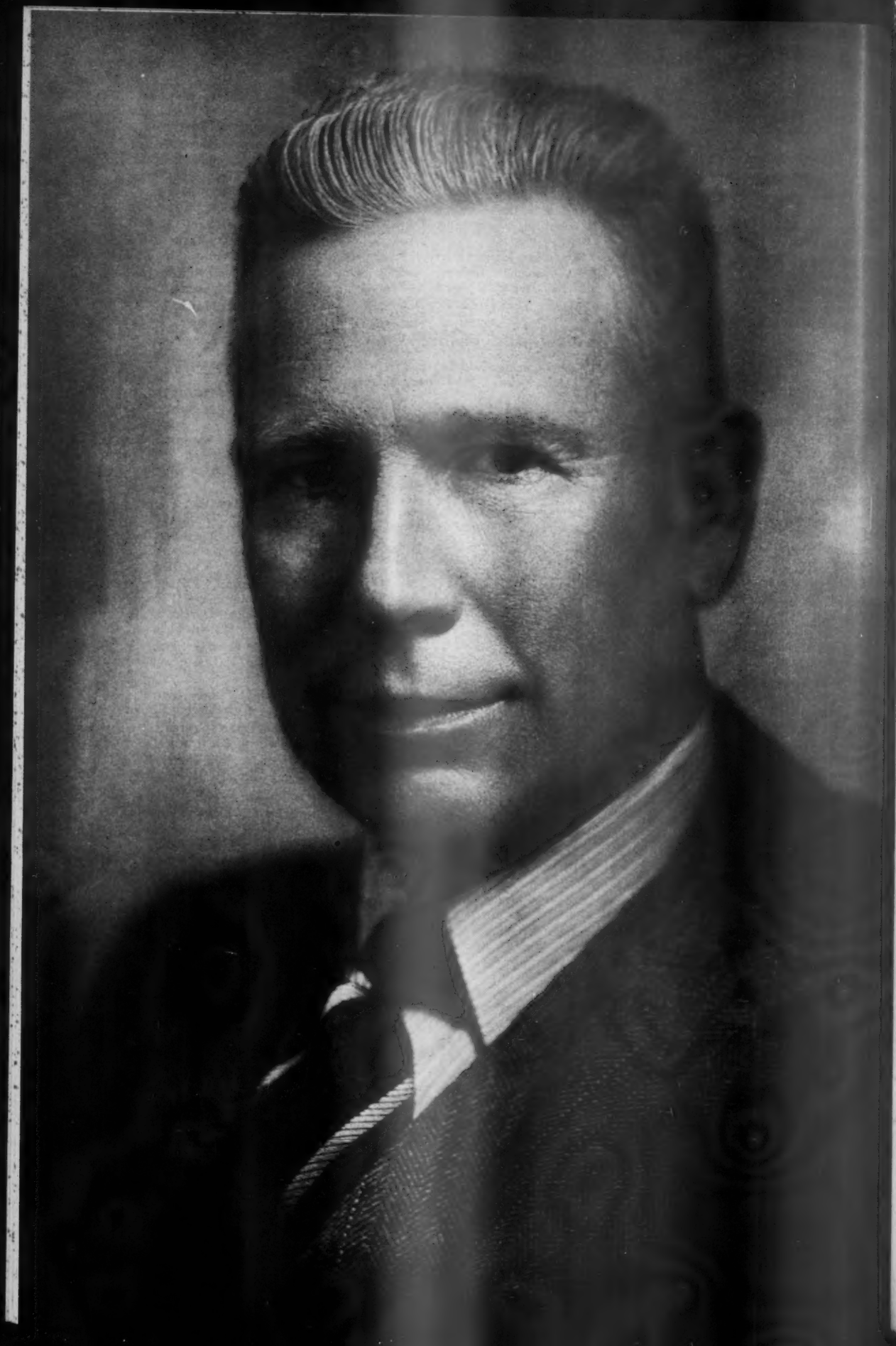
Towers, Harold Reynolds, B.Ae.E.; Ensign, U.S.N.R.

Wales, Victor S., B.S.; Graduate Student, Carnegie Institute of Technology.

I.A.S. National Meeting Schedule

Aircraft Propulsion Meeting—Cleveland, Ohio, Carter Hotel—March 28, 1947
Personal Aircraft Meeting—Detroit, Mich., Horace H. Rackham Educational Memorial—May 26-27, 1947
Annual Summer Meeting—Los Angeles, Calif.—August 7-8, 1947

All correspondence should be addressed to the Meetings Committee
Institute of the Aeronautical Sciences, 2 East 64th Street, New York 21, N.Y.



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Editorial

Recognition

It is one of the commoner anomalies in human experience that the greatest satisfactions frequently come from the simplest things. None of us in his right mind would look down his nose at wealth or position, honestly attainable, but it is a fair guess that more men, rich or poor, have drawn more personal satisfaction from the simple recognition by others of a job well done than from the mere accumulation of material wealth. From the dawn of history, the accolade, the Doctorate, the Fellowship, or the bit of bright ribbon have been sought more eagerly than access to the King's Treasury.

The Institute of the Aeronautical Sciences could not, if it would, grant rewards of great intrinsic value to its members in recognition of their achievements. Who could evaluate (to say nothing of compensate for) in terms of material things, the worth to aviation in America of an Orville Wright, a George Lewis, a Glenn Martin, or a "Hap" Arnold? Their contributions have been beyond price. We can, however, recognize them as a group apart and pay them due honor for high accomplishment by electing them to the Institute's highest pinnacle—Honorary Fellowship. Never an easy task, this year the choice was especially difficult. Reviewing the record of scientific contribution in aeronautics over the past few years, it may well be said that seldom has so much been owed to so many. By secret ballot, the Fellows of the Institute have made their choice. We welcome to the distinguished company of Honorary Fellows, Frank Walker Caldwell.

Honorary Fellowship in the Institute is not limited to Americans any more than achievement in aeronautics is limited to the inhabitants of any particular quarter of the globe. The I.A.S. Constitution provides that one may be elected each year from among the American Fellows, and one from outside the United States. This year the choice fell on Sir Geoffrey de Havilland, a brilliant engineer and a distinguished gentleman. The entire membership of the Institute is honored by his acceptance.

Two other well-known names from overseas were added to the roster of the Fellows, Captain J. Laurence Pritchard, long-time Secretary of The Royal Aeronautical Society, and Dr. H. Roxbee Cox, of Power Jets, and 1945 Wright Brothers Lecturer. They are the first Foreign Fellows to be elected since 1939. We welcome them.

In addition to the ten American Fellows elected every year from the Associate Fellows of the Institute (the names of the 1946 Fellows will be found on page 10), the Institute is the custodian of six special awards that are granted each year in recognition of achievement in several fields of aeronautics. Elsewhere will be found the histories, the citations, and the recipients of these honors. It is sufficient here to indicate that the Reed Award is given for experimental or theoretical work; the Bane Award to an Air Force officer or civilian for contribution to military aeronautics; the Losey Award for work in meteorology; the Jeffries Award for advancement in aero-medicine; the Chanute Award to a pilot for flight-test research; and the Sperry Award to a young man for the advancement of aeronautics. The selection of recipients is conducted by secret ballot of the Trustees or Committees as established by the donors or by the Council of the Institute.

Some of the Awards carry with them small honorariums, others do not. These monetary considerations are comparatively small and were not intended by the donors as an indication of the relative importance of the awardee's contribution to the art.

Among the primary purposes of the Institute is the fostering and encouragement of advances in aeronautics by every possible means. We cannot underwrite vast research projects, nor have we been able, as yet, to establish scholarships or to provide other direct financial aid to genius, no matter how promising. Thanks to the energy and the foresight of Lester Gardner, however, the Institute has, in its annual Honors List, the most appropriate possible means of fostering aviation by giving adequate recognition to those who contribute mightily to its progress.

S. P. J.

1946 Honorary American Fellow, Frank Walker Caldwell

NAVAL NEEDS...

Excerpts from I.A.S. Navy Day Luncheon Address

"Problems of Naval Aviation Confronting the Aeronautical Engineer"

By

REAR ADM. L. C. STEVENS, U.S.N.

Assistant Chief, Bureau of Aeronautics, for Research and Development

"AN ACCOUNTING of the problems of naval aviation confronting the aeronautical engineer cannot properly be a listing of small needed improvements, but should rather touch on the broader problems which offer the widest scope for imaginative approaches. It is a keenly felt responsibility of the Navy Department, not to hem such problems about with restrictions based on prior operating conditions, but rather to preserve the opportunity for the imaginative approach. . . . .

"The transition to jet propulsion in naval carrier aircraft, which is now going on, presents some problems peculiar to the Navy. The comparatively poor static thrust of jet engines enhances the difficulty of launching from the restricted flight deck areas. Although the thought of use JATO (jet-assisted take-off) to shorten take-off distance at once comes to mind, there are no such units which are completely satisfactory from the standpoint of logistics of quantity stowage, or even of freedom from smoke and fumes. Catapults offer another ready solution, but the weight and minimum flying speed of probable future jet aircraft will lead to very heavy catapults if conventional practices are followed. The recovery of jet aircraft by normal carrier landing technique presents some minor problems, principally by reason of the decreased available thrust at low speeds.

"Many members of this Institute have witnessed carrier operations on the U.S.S. 'Tarawa' and U.S.S. 'Boxer' and have been impressed by the special problems which have been solved for conventional airplanes, of rapid and precise deck handling techniques under crowded conditions. These same problems have not yet been solved for jet-propelled airplanes. The jet blast may eventually make it impossible to taxi an airplane out of a crowded spot position. Special provision for run-up tests will be required. Rapid placement of airplanes in catapulting position will probably require external assistance. In fact, the entire deck-handling procedure will probably be highly mechanized, involving conveyer-type equipment, blast deflectors, and the like. Associated with this is the continuing need for rapid servicing and rearming.

"Of the several parameters by which we state airplane performance, there has been one which has not shown a high degree of improvement. This is range. There have been only two possibilities presented whereby the useful range of aircraft can be increased significantly. First, there has been a small increase with increased size of aircraft, a solution which is often not attractive for Naval purposes. Second, some rather elaborate investigations have established that more improvement can be obtained by better operating methods than by better design. This conclusion is of use to engineers only insofar as it suggests that better design would narrow the opportunity for inefficient operation. At this point it is customary to point out that the advent of nuclear propulsion will solve the range problem forever. Although this statement may be eventually correct, it by no means affords sufficient reason for allowing the range problem to lie dormant in the meantime. This is particularly true since the advent of jet aircraft, which makes the range problem worse rather than easier.

"The field of antisubmarine warfare is perhaps one which offers the greatest reward for imaginative thinking by engineers. Much has been declassified and published regarding the equipment and methods which were used against submarines in World War II. These equipments and methods were effective against submarines which had to spend frequent long periods on the surface, and which were pinned down to very low speeds and short radii while submerged. Manifestly, submarines with schnorkel, capable of sustained high submerged speed will present a very different problem. . . .

"The new potentialities of submarines afford also a stimulus toward development of new offensive combina-

tions with aircraft. The launching of guided missiles from underwater craft is an obvious possibility. Perhaps a more radical departure from present-day convention would be the vertical take-off and landing of high-performance, manned aircraft. Unorthodox as this sounds, it would seem that the present trend toward lower thrust loadings will, if continued, ultimately reduce this problem to one of low speed control.

"The application of electronics to Naval aircraft presents an endless vista of problems and opportunities for technical advancement. It is a vista in which we have already seen such suggestions ranging from completely automatic programmed flight operation down to so unexpected a device as an electronic carburetor. Much has already been done to show that electronic devices can be integrated with aircraft in a way which, by replacing human perception and the simpler forms of direct judgment or choice, can enable flight to be carried out under otherwise impossible conditions.

"Our experience during the war with electronic gun sights, bombsights, computers, and automatic pilots, successful as it was, afforded little more than a sampling of the future possibilities of the techniques which were being put to use in many cases for the first time. Most of these devices involved the control of flight with a tendency toward a diminishing degree of intervention by the human pilot. In proceeding toward this greater automatism we learned a lesson, which should have been obvious all along, that the design of the control device must be considered as a part of the aircraft design. For this lesson we coined the term 'systems design,' which term serves as a reminder that we cannot yet hope to design a black box which, when plugged into any airplane, will control it as a human pilot would. The conclusion is that the adaptation of electronics to automatic control of aircraft is a problem in which aerodynamic design, mechanical design, and electronic design are inextricably mixed.

"One phase of the automatic control problem which is of special interest to Naval Aviation is concerned with all-weather carrier operation. Here there are some special difficulties and some special factors which are helpful. The rolling and pitching motion of the ship, for example, not only adds a factor of difficulty to the blind landing itself, but also complicates the control problem by imposing the necessity of stabilizing certain kinds of shipboard devices which might be used in a blind landing control system. On the other hand, the ships themselves are amply supplied with sources of power, electronic systems and such airplane devices as launching and arresting gear which can be used as aids rather than handicaps. . . . .

"It is a matter of observation that the past increases in speed of aircraft have been attended by an expansion of the geometry of flight. . . . . Unfortunately, however, this expanding geometry will ultimately present us with another human limit, the range of visual perception. At 300 m.p.h. an airplane will turn in a diameter of about three-fourths of a mile without exceeding an acceleration of 3g's applied to the pilot. At 1,500 m.p.h. and still at 3g's, the turning diameter would be 25 times as great, or about 18 miles. Similarly, at 1,500 m.p.h., an object seen 5 miles ahead is reached in 12 sec. Clearly, if the human pilot cannot see and discriminate objects of reasonable size across his turning circle, or a few seconds away from collision ahead, he needs some such mechanical assistance to vision as can be afforded by electronic devices. . . . .

"We are right now in the transonic range, and many of us believe that the difficulties of flight in that range must be overcome before piloted flight at supersonic speeds will even be open to serious exploration. It is generally agreed that many problems of design for transonic flight must be solved by free flight experimentation, under conditions which would present elements of serious personal danger to human test pilots. The notions of remote control and of transmission of flight-test data are natural ones, and these possibilities have been under development for some time, with rather gratifying results to date. However, we soon encounter the difficulty, which I mentioned before, that no 'black box' can be devised which can be simply and surely adapted to an airplane for which it was not designed, and thereafter provide successful control. For best results, the control equipment and the airplane should be designed together, for operation under known conditions, whereas our problem involves the exploration of the many unknown factors in the design and operation conditions of a little explored flight range. Thus, further progress in remotely controlled flight testing is itself a major objective of the Bureau of Aeronautics.

"The design of guided missiles for use from ships and from naval aircraft includes many unique problems. There is the obvious condition of launching from a moving platform, which, even if gyro-stabilized, is still displaced in space. Another obvious condition is that of rigid space limitation on shipboard, which carries with it the less obvious corollaries of high accelerations due to compactness of launching devices, rapidity of repeated launchings rather than multiple launching devices, rapidity of assembly, and maximum efficiency for stowage.

"Still less obvious are the stowage limitations on space and weight of fuels, safety considerations of ships' crews, transportation, and handling on shipboard from stowage to launching position, the necessity for magazine stowage of explosives, and the special conditions of security under which radio and radar equipment must operate from ever shifting positions in enemy waters. . . . .

"The answers to all of these problems are important, but each new answer will disclose new problems ahead, as the broad front of technological progress moves on. One problem, however, will retain its present importance: that is the problem of retaining the interest and the creative imaginative help of the engineers, without which no progress is possible."

I.A.S. Briefs

Summaries of current papers received for publication or presentation at I. A. S. meetings

This Section, appearing for the first time with this issue of the REVIEW, *has been established to give advance and current information on papers presented to the Institute for publication or for presentation at meetings. Summaries of all pertinent papers, including those given at Section and Student Branch meetings, will be published each month in these columns as rapidly as they are received from authors.*

Many of these papers, after being processed by the Editorial Committee in the usual manner, will appear in full in later issues of the JOURNAL *or* REVIEW. *Preprints of some papers are immediately available, or will become available at an early date, at a price of 25 cents each (to cover handling costs) to I.A.S. members, and 75 cents each to nonmembers. Requests for preprints should be addressed to Editorial Department, Institute of the Aeronautical Sciences, 2 East 64th Street, New York 21, N.Y.*

Aerodynamics

The Use of Damping Screens for the Reduction of Wind-Tunnel Turbulence

By

Hugh L. Dryden and G. B. Schubauer

National Bureau of Standards

The experiments described show that damping screens materially reduce the turbulence of an air stream. By their aid it is possible to obtain turbulence levels as low as 0.02 to 0.05 per cent. From investigations carried out at the National Bureau of Standards in 1940 with the cooperation and financial assistance of the National Advisory Committee for Aeronautics, a theory to explain the action of damping screens was formulated. Publication of the results was withheld at that time for security reasons. The work of 1940 is the only known systematic investigation of damping screens in which hot-wire measurements of turbulence were made and, therefore, the results of the investigations should be of interest. The experiments were conducted in the rebuilt N.B.S. $4^1/_2$-ft. wind tunnel. The damping screens were installed in the settling chamber and turbulence measurements were made with hot-wire turbulence-measuring equipment. The method of measurement is briefly described. Data are available on four single screens, two screens in series, three screens in series, and six screens in series. Detailed results of the measurements in the test section and of the measurement in the settling chamber are given in tables. To facilitate comparison with theory, the results in the test section pertaining to a single speed (about 109 ft. per sec.) have been summarized in a table, and the values shown agree with the predictions of the theory well within the precision of the experiments, except for the six-screen combination.

Development of the theory of the effect of screens is discussed. Prandtl in a paper published in 1933 called attention to the use of screens for improving the velocity distribution and gave a simple theory of the effect. The possibilities of damping screens were not fully realized until 1938 when a 60-mesh screen was installed in the entrance cone of the old N.B.S. $4^1/_2$-ft. tunnel and turbulence measurements made in the test section showed a reduction in turbulence from 0.54 to 0.19 per cent. Other theories of the effect of screens have been proposed in addition to Prandtl's, among them Collar's regarding the effect of a screen on the velocity distribution and Batchelor's regarding the effect of screens on both velocity distribution and turbulence. The relatively simple theory given in this paper is the only known one that agrees even approximately with the observed effect of screens on turbulence. The effect of a damping screen in reducing the turbulence of an air stream is found to depend on the pressure-drop coefficient, k, of the screen. The intensity of the turbulence is reduced in the ratio $1/\sqrt{1+k}$ by a single screen and in the ratio $1/(1+k)^{n/2}$ by n identical screens in series. These relations show that for the same power expenditure a greater turbulence reduction can be obtained with a number of screens of small k than with a single screen of coefficient nk. The theory takes no account of any turbulence set up by the screen itself and therefore may predict values too low. This, of course, depends on the fineness and uniformity of the screen. The turbulence set up by the screens themselves may be the limiting factor in the attainment of low turbulence, but in the $4^1/_2$-ft. tunnel the principal limiting factor is probably the tunnel noise. While velocity fluctuations arising from a sound field should not be classed as turbulence, they, like turbulence, are generally an undesirable source of disturbance and should be reduced as much as possible. The information available on the effect of a contraction on turbulence is not sufficient to permit the exact computation of the turbulence levels to be expected in wind tunnels of different contraction ratios.

A Method for Calculating Airfoil Sections from Specifications on the Pressure Distributions

By

Glenn H. Peebles

Douglas Aircraft Company, Inc.

In 1938, W. Mangler solved a problem in the theory of conformal transformations which may be loosely stated as follows: *The magnitude of the velocity on an airfoil section is given as a function of the profile arc length. Find the profile having this predetermined velocity distribution.* A thorough investigation of his solution shows that by changing the approach and by devising accurate and speedy means of performing the naturally lengthy calculations, the notion of constructing an airfoil section to give a prescribed pressure distribution can be made to yield an excellent tool for airfoil design—within the limits, of course, set by the theory of incompressible inviscid flow. One begins a profile design by tentatively specifying the pressure distributions desired at selected angles of attack. These specifications, which usually conflict with each other, are reconciled so as to correspond to an existing but unknown profile. The coordinates of the section are then accurately and rapidly calculated.

The Subsonic and Supersonic Flow about Slender Bodies

By

E. V. Laitone

Cornell Aeronautical Laboratory

New first and second order solutions are obtained for the subsonic and supersonic flow about bodies of revolution. The surface pressures are obtained through a Taylor Expansion of the cross-sectional area. The resulting simple expressions are found to be in satisfactory agreement with existing experimental data. It is shown that previous solutions of the linearized supersonic flow equations have retained terms which were incompatible with the basic potential equation of compressible flow.

Extremely simple relations are developed for the lift and moment of bodies of revolution in inclined subsonic and supersonic flow. These relations are shown to be in good agreement with experimental measurements. It is shown that the commonly used linearized solution for the supersonic flow about an inclined body of revolution is incorrect since nearly all of the terms retained are of a higher order than the terms omitted in neglecting the effect of the velocity component due to the axial flow.

Expressions are also presented for computing the two-dimensional compressible flow about sharp nose airfoils. The computed surface pressures are in excellent agreement with experimental measurements on typical wedge and biconvex airfoils in subsonic and supersonic flow.

This column will normally contain summaries of papers received from all sources. Because of space limitations and the number to be covered, this issue is devoted exclusively to papers presented at the Fifteenth Annual Meeting of the Institute in New York, January 28, 29, and 30, 1947. Summaries of several others, which were not available at the time of going to press, will be published in the March issue of the REVIEW.

Excerpts from the luncheon address by Rear Adm. L. C. Stevens will be found on the two preceding pages. Summaries of the addresses given by the Hon. W. Averell Harriman at the Honors Night Dinner, by Major Gen. L. C. Craigie at the Army Day Luncheon, and by the Hon. William A. M. Burden at the C.A.A. Day luncheon, will appear in the REVIEW *next month.*

Laminar Boundary-Layer Oscillations and Stability of Laminar Flow

By

G. B. Schubauer and H. K. Skramstad

National Bureau of Standards

An account is given of an experimental investigation conducted in the Bureau's $4^1/_2$-ft. wind tunnel in 1940 and 1941 in which sinusoidal velocity fluctuations were discovered in the laminar boundary layer along a flat plate, and in which the characteristics of these fluctuations were studied and found to agree with the characteristics predicted earlier by the Tollmien-Schlichting stability theory. This work confirmed the theory, settling a controversy of many years and throwing new light on the causes of transition from laminar to turbulent flow. The work was done with the cooperation and financial assistance of the National Advisory Committee for Aeronautics and was published originally as an N.A.C.A. Advanced Confidential Report. The present review has been made possible by the declassification of the original report.

Linearized Treatment of Supersonic Flow Through and Around Ducted Bodies

By

H. F. Ludloff

New York University

The method of distributed "sources and sinks," first applied by von Kármán and Moore to supersonic flow problems, is further developed and used for the detailed computation of the field of supersonic flow through and around ducted bodies. "Sources and sinks" are distributed on the wall of a hollow cylinder with appropriate intensity, so that also internally reflected Mach waves may be derived.

The general relation between the shape of the body and the intensity of the source distribution producing the desired flow is explained. The velocity field in the duct is discussed. Particular attention is paid to the conical shock wave, originating at the mouth of the duct, and to the discontinuities connected with it. Since the Entrance Shock is particularly strong at the vertex of the cone, this region is discussed in an approximate manner. It can be shown that the front rim of the duct will have an important influence on the kind of discontinuity that develops in the flow pattern. The duct wall can be designed accordingly. The supersonic wave drag is discussed.

Aircraft Propulsion

A Survey of the Calculated Performance of Jet Power Plants

By
Joseph H. Keenan and Joseph Kaye
Massachusetts Institute of Technology

The development of the gas turbine and of jet propulsion has indicated that aircraft power plants of the future will consist of various combinations of certain elements. These elements are propeller, diffuser, compressor, combustion chamber, turbine, propulsive nozzle, and reciprocating engine. In order to bring this complex subject into somewhat better focus, the combinations that appear to be important to aircraft development have been studied for the effect of certain major variables, namely, pressure ratio, speed, and—to a lesser extent—maximum temperature and diffuser efficiency. An attempt is made to compare the efficiencies of moving power plants with stationary ones so as to give the whole subject some degree of coherence.

The principal reference lines for correlating the efficiencies of moving and stationary power plants are, aside from the axes of coordinates, the line of constant pressure ratio for compression to the temperature at turbine inlet, the line of constant efficiency for Carnot efficiency corresponding to atmospheric and turbine-inlet temperatures, and the curve for the simple gas turbine with reversible compressor and turbine—the latter being also the curve of maximum efficiency for the moving turbopropeller with reversible propeller, diffuser, compressor, turbine, and exhaust nozzle.

Air Transport

Radio Aids to Navigation

By
D. M. Stuart
Civil Aeronautics Administration

The radio aids to air navigation in the short-distance and instrument-landing categories which were recently adopted by P.I.C.A.O. for international standardization comprise a well-integrated system. A highly efficient utilization of ground and air-borne equipment is achieved through ability to obtain several essential services from each unit of the system. The basic air-borne installation consisting of V.H.F. navigation receiver, U.H.F. glide path receiver, U.H.F. distance measuring equipment, and offset course computer, provides for en-route navigation along any desired track, simultaneous en-route-communication, instrument approach and landing, and approach control communication. Total weight of air-borne equipment is approximately 75 lbs. The form of presentation in the aircraft is suitable for automatically controlled flight and landing, and for automatic reporting of identification and position in response to ground interrogation.

Ground facilities include V.H.F. omniranges, V.H.F.-U.H.F. instrument landing systems, and associated distance measuring beacons. Since some of the elements of these facilities perform basically similar functions, it has been possible to effect a high degree of standardization in the equipment employed. The use of minimum of equipment types results in important economies in procurement and in stocking of spares. Maintenance procedures are also simplified and a higher degree of operational reliability is obtained.

Transport Problems with Turbine Power Plants

By
Frank W. Kolk
American Airlines, Inc.

Because both the turbojet and turboprop types of power plant appear to have immediate application to transport aviation, operational problems of these types should be considered. These problems include the proof of mechanical reliability of both engines and control apparatus, the ability to operate under icing conditions, the ability to operate at low speeds and low altitudes with low fuel consumption, and the availability of a suitable inexpensive fuel. In addition, turbine-propelled airplanes, especially turbojets, will impose operational problems far beyond the ability of present navigational and traffic-control methods. Other related airplane problems are pressure cabin reliability, loads imposed by rough air, and location of fuel. Because these problems are so basic in nature, information and ideas on all phases of the problem should be made readily available to all interested parties, namely—the engine manufacturers, airplane manufacturers, and transport operators.

Flight Test

Progress in Dynamic Stability and Control Research

By
William F. Milliken, Jr.
Cornell Aeronautical Laboratory

This paper presents a résumé of the dynamic stability and control research program currently under way at Cornell Aeronautical Laboratory, with particular reference to the accomplishments of the last year.

Reference is made to a series of flight-test investigations which were made utilizing automatic control, and to the specialized instrumentation developments and methods of analysis. Emphasis is placed on the broad aspects of the program and how the specific aspects are integrated to maintain a directed effort toward the determination of dynamic stability and control characteristics, and the utilization of this information in design of airplanes and missiles. The future trends and contemplated development of this work are discussed.

Flight Testing of Guided Missiles

By
Harold K. Cheney
Consolidated Vultee Aircraft Corporation

The general problem of flight-testing guided missiles is introduced by comparing operating conditions to those of piloted aircraft. With guided missiles, the initial flights may be simplified since a safe landing is not required. They normally operate at rapidly changing conditions while most of piloted aircraft testing is done at steady conditions. Missile flights are free of human variation but they do not have the advantage of the test pilot as an adaptable mechanism for observing conditions, analyzing situations, and applying corrective controls. Guided missiles usually operate under conditions where meager correlation exists between theory, wind tunnel, and flight. These and other comparisons are discussed.

The general instrumentation requirements for guided missiles are outlined. The equipment already available from air-

craft and ballistic testing is discussed. The accuracy necessary to obtain satisfactory data at rapidly varying conditions is illustrated and the necessity for cross-checking information between various sources of data stressed. General procedures recommended for carrying out the test program are indicated. Examples of early experience are presented. It is emphasized that to obtain full value from the extremely high cost of a guided-missile flight, a thorough analysis must be made.

Meteorology

Pressure Measurements in the Upper Atmosphere

By

Nolan R. Best

Naval Research Laboratory

By the use of V-2 rockets fired at White Sands, N.M., direct measurements have been made of pressures in the upper atmosphere corresponding to heights of from 60 to 85 km. Interpretations of the data obtained must be regarded as purely preliminary. There is, however, a definite correlation to be noted between the measurements and the N.A.C.A. tentative standard atmosphere. Tungsten wire Pirani gages were used in locations near the tail where German wind-tunnel data indicated that ambient pressure would be measured directly. The correctness of the German data was verified by means of comparing bellows gage measurements made in the lower portion of the projectory with balloon sounding data.

Discussion of the Possibility of Weather Control

By

Dr. V. K. Zworykin

Radio Corporation of America

The electronic computing devices that are contemplated will, in effect, constitute miniature models, with greatly accelerated time scale, of our atmosphere and the factors influencing it. To begin with, the model will necessarily be imperfect, corresponding with our imperfect knowledge of atmospheric processes. However, the repeated experimental modification of the empirical laws governing processes in the model and a comparison of the resulting outcome with the observed evolution of the weather will lead to a progressively closer approximation between the model and reality and, hence, to both a greater precision in the forecasts supplied by the model and a better understanding of meteorological phenomena.

In addition to speedy, accurate weather prediction, the electronic forecasting system will offer a unique opportunity for the control of localized weather disturbances. The latter are commonly preceded by the accumulation of large quantities of energy in an unstable or metastable state; this energy may be released upon the application of a relatively small amount of energy at the proper point. Since the electronic model will reveal the effect of adding fixed amounts of energy at various points and various phases of the weather map, it will indicate the most economic fashion of modifying the release of the stored energy in a desired direction or otherwise influencing the evolution of the weather disturbance.

Among the many economically important weather disturbances that might thus be controlled—such as local frosts, fogs, and thunderstorms—the hurricanes that wreak destruction in the Florida Gulf area offer a good example. Atmospheric disturbances created artificially by the burning of oil slicks in appropriate places, as determined by model experiments on the electronic forecaster, may be effective either in interfering with the genesis of the storms or in deflecting their paths into regions where the resulting damage will be slight.

Observations on the weather disturbances over tropical islands, burned-over areas, etc., indicate, furthermore, that the artificial variation in the absorption of extended areas for solar radiation may be similarly effective in bringing about important changes, predetermined with the electronic forecaster, in the weather phenomena in a particular area. Electronic methods, applied in the field of weather control, may thus prove a powerful tool in warding off catastrophe and in promoting human welfare.

Rotating Wing Aircraft

Mechanical Instability of a Two-Blade Helicopter Rotor on Anisotropic Supports

By

Dr. Robert P. Coleman and A. M. Feingold

National Advisory Committee for Aeronautics

It is known that rotating wing aircraft may experience violent vibrations while the rotor is turning and the aircraft is on the ground. It has previously been found that these vibrations can be explained without considering aerodynamic effects and that they involve mechanical coupling between horizontal hub displacement and blade oscillations in the plane of rotation.

The problem may be divided into several cases that are characterized by the number of blades and by whether the supports are assumed to have equal or unequal stiffness in different horizontal directions. The cases that involve equations of motion having constant coefficients have already been treated in N.A.C.A. publications. The missing case (one or two blades on unequal supports) involving equations of motion having periodic coefficients is treated in the present paper.

This paper is a presentation of the material contained in an N.A.C.A. Technical Note entitled "Theory of Ground Vibrations of a Two-Blade Helicopter Rotor on Anisotropic Flexible Supports," by R. P. Coleman and A. M. Feingold.

Structures

Critical Speeds of Shafts Under Torque

By

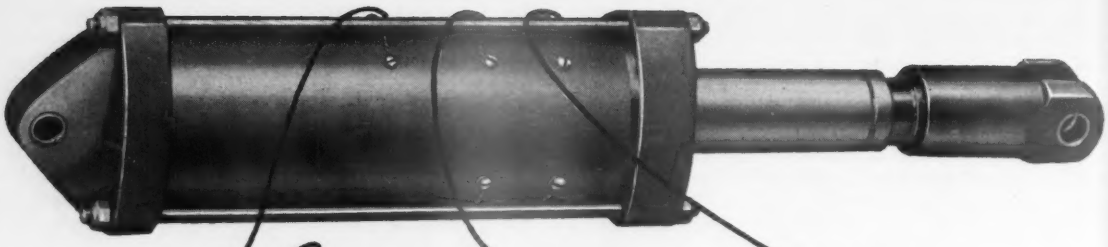
Reinhardt M. Rosenberg

Purdue University

In airplane configurations of certain recent designs where the propeller is located aft of the tail surfaces, it is driven by a long drive shaft subjected to high torque. A shaft that is subjected to torque has a critical speed different from that of the same drive shaft not under torque.

This paper contains an exact analysis of the critical speed of shafts under torque, resulting in a condition on the critical speed, necessary to satisfy exactly the differential equations of the problem. This solution is, in its present state, too laborious to be useful from an engineering point of view. Therefore, an approximate solution of the problem, relying on Raleigh's principle of energy equilibrium, is given as well.

This approximation results in a simple expression for the critical speeds of shafts (or the natural frequencies of beams) under torque. It is found that the critical speed of the shaft under torque is always greater than that of the same shaft under zero torque. The cases treated are the shaft between universal joints and the shaft pin-ended on one plane only. The formulas reduce to the familiar expressions for critical speeds when the applied torque equals zero.



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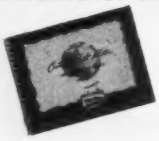

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Aeronautical Reviews

Aerodynamics

A Method for Calculating Airfoil Sections From Specifications on the Pressure Distributions. Glenn H. Peebles. *Paper presented at I.A.S. 15th Annual Meeting*, New York, January 28–30, 1947. (For abstract see "I.A.S. Briefs" on page 25 of this issue, February, 1947.)

The Subsonic and Supersonic Flow About Slender Bodies. E. V. Laitone. *Paper presented at I.A.S. 15th Annual Meeting*, New York, January 28–30, 1947. (For abstract see "I.A.S. Briefs" on page 25 of this issue, February, 1947.)

Laminar Boundary-Layer Oscillations and Stability of Laminar Flow. G. B. Schubauer and H. K. Skramstad. *Paper presented at I.A.S. 15th Annual Meeting*, New York, January 28–30, 1947. (For abstract see "I.A.S. Briefs" on page 25 of this issue, February, 1947.)

Linearized Treatment of Supersonic Flow Through and Around Ducted Bodies. H. F. Ludloff. *Paper presented at I.A.S. 15th Annual Meeting*, New York, January 28–30, 1947. (For abstract see "I.A.S. Briefs" on page 25 of this issue, February, 1947.)

Exact and Approximate Solutions of Two-Dimensional Oblique Shock Flow. Edmund V. Laitone. *Journal of the Aeronautical Sciences*, Vol. 14, No. 1, January, 1947, pp. 25–41, 58, figs. 11 references.

A simplified presentation is made of the exact and approximate solutions of supersonic flow over two-dimensional bodies. The data are all presented as a variation with the free stream Mach Number, thereby enhancing their usefulness. An exact solution is given for the maximum flow deflection that can be obtained by means of an oblique shock wave at a given Mach Number. The third and higher terms are presented for the infinite series approximating oblique shock flow. The third term obtained is not the same as that originally given by Busemann in 1935 at the Fifth Volta Congress. The new third term is analyzed to show that under certain conditions an oblique shock flow may be considered isentropic even though the third order of the flow deflection or pressure discontinuity is not negligible. A reliable graphical method is presented whereby the pressure distribution may be quickly and accurately obtained for a two-dimensional body in a supersonic flow field.

Supersonic Nozzle Design. A. E. Puckett. *Journal of Applied Mechanics*, Vol. 13, No. 4, December, 1946, pp. A-265–A-270, figs. 8 references.

A two-dimensional flow field in which the velocity is everywhere supersonic can always be represented approximately by a number of small adjacent quadrilateral flow fields in each of which the velocity and pressure are constant. These quadrilaterals must be separated by lines representing waves in the flow. Changes in velocity and pressure through any wave can be computed. By increasing the number of small areas into which the complete flow field is divided, the accuracy of this approximate solution may be increased without limit. This constitutes the "method of characteristics" solution, which has been known for many years. This method may be applied to the graphical computation of flow in a supersonic nozzle, with the particular aim of producing uniform supersonic flow at the end of the nozzle. Such a computation is essentially simple and rapid, and its essential features are presented in a form that may be easily applied to engineering problems.

Supersonic Flow Past Bodies of Revolution. M. J. Lighthill. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2003*, January 3, 1945. 24 pp., figs. 3 references. British Information Services, New York. $1.35.

This paper is a development of the work of von Kármán and Moore. For slender bodies of revolution pointed at both ends, the slope of whose meridian section is continuous, a theory is developed which gives the velocity distribution over the whole field correct to the first and second orders in the thickness of the body, when it is placed in a uniform supersonic stream flowing in the direction of its axis. The asymptotic value of the drag as the thickness tends to zero is expressed in terms of the cross-sectional area of the body at a given distance along its length. The drag coefficient is thus independent of Mach Number to this approximation, and varies as the square of the fineness ratio (so that for a given length the drag itself varies as the fourth power of the thickness). Possible limitations are indicated. A theory is then worked out for supersonic flow in and around open tubes of approximately cylindric shape. The pressure at any point on the

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outer and inner surface is calculated in terms of the shape, and hence the drag is known. Other points about the flow are discussed.

Similarity Laws of Hypersonic Flows. Hsue-Shen Tsien. *Journal of Mathematics and Physics*, Vol. 25, No. 3, October, 1946, pp. 247–251. 4 references.

The von Kármán method of obtaining similarity laws for transonic flows where the velocity is near that of sound is used to derive the similarity laws for hypersonic flows. Use is made of an affine transformation of the fluid field so that the differential equations of the flows are reduced to a single nondimensional equation. These laws are expected to be useful in correlating the experimental data to be obtained in the near future by hypersonic wind tunnels now under construction.

Compressibility Increase of Lift and Moment on EC 1250 for Low Speed C_L 0.17. J. A. Beavan and G. A. M. Hyde. *Gt. Brit., Aeronautical Research Committee, Reports and Memoranda No. 2055*, September 22, 1942. 14 pp., figs. 6 references. British Information Services, New York. $0.90.

Pressure-plotting measurements were made on an airfoil of 5-in. chord over a range of Mach Numbers 0.3 to 0.83 and at 0° and 2° incidence (low-speed $C_L = 0$ and 0.17), in the 20-in. by 8-in. Rectangular High-Speed Tunnel, use being made of the flexible walls parallel to the airfoil to allow for tunnel interference. The pressure distributions were integrated for lift and moment for comparison with the rise expected on the basis of von Kármán's extension of the Glauert formula $1/\sqrt{(1-M^2)}$ which applies only to extremely thin airfoils. Unlike the American NACA 4412 airfoils, the lift coefficient at 2° increases little, but the moment increases much faster than von Kármán's formula would predict. The reason is seen to be an increase in size of a negative loop in the pressure curve toward the tail, although the von Kármán formula is verified over most of the airfoil surface. Probably $C_L = 0.17$ is too great a departure from the designed condition (in this case $C_L = 0$) with this airfoil, which has an extremely flat theoretic distribution and a transition point that is normally far back. Although there is a small disturbance of the lift curve before the critical Mach Number of 0.725, the usual lift shock stall does not occur about Mach Number 0.81, being preceded by a large fall in the moment curve at Mach Number 0.77. The moment of the last quarter-chord about its front edge, corresponding to the hinge moment of an aileron at zero setting, also was worked out and shows a much more rapid increase with Mach Number than Glauert's formula.

The Effect of a Sharp-Nosed Leading Edge on the Boundary Layer of a Flat Plate. R. H. Dalitz. *Australia, Council for Scientific and Industrial Research, Division of Aeronautics, Report No. A. 40*, December, 1945. 28 pp., figs. 7 references.

The potential flow along a flat plate of finite thickness with a sharp leading edge consisting of two circular arcs is determined by conformal transformation. Taking this velocity distribution along the plate as a first approximation, the characteristics of the boundary layer on the plate are then calculated by an approximate method suggested by Piercy and Whitehead. It is found that at a distance from the curved forward edge, the boundary layer approximates a Blasius form, corresponding to that of a thin flat plate with its leading edge some distance ahead of the leading edge of the actual plate. Further approximations have a negligible effect on the boundary layer far down the plate.

A Critical Review of German Research on High-Speed Airflow. R. Smelt. *The Royal Aeronautical Society, Journal*, Vol. 50, No. 432, December, 1946, pp. 899–927, Discussion, pp. 927–934, figs.

Reference is made to the contributions to high-speed research by the different German research stations. The characteristics of German high-speed wind tunnels are summarized. Consideration is given to the design of high-speed supersonic wind tunnels, the humidity effects in these tunnels, and features of the Mach interferometer used to examine the velocity field around the model. The important experimental results that the Germans obtained with their equipment are discussed in sections dealing with research at subsonic and at transonic speeds. In conclusion it is pointed out that the immense scale of German effort in this branch of aerodynamic research was largely wasted, from the German point of view, apparently because of the extraordinary inertia of German aircraft firms and the comparative isolation of research workers from the industry. Some of the ideas developed, such as the application of sweepback and low aspect ratio, show promise of marking a new era in aeronautical design.

Subsonic and Supersonic High Speed Tunnel Tests of a Faired Double Wedge Aerofoil. W. F. Hilton and F. W. Pruden. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2057*, December 18, 1943. 15 pp., figs. 6 references. British Information Services, New York. $0.90.

An airfoil designed by one of the writers was tested at Mach Numbers from 0.4 to 0.82 and at Mach Numbers 1.21 and 1.45. The airfoil was 8.7 per cent thick, and consisted of two wedges each of total angle 11.59°, faired by circular arcs. It was found to be free from serious compressibility effects at these speeds. Ackeret's and Busemann's theories apply quite well at Mach Number 1.45, but the drag coefficient requires the addition of 0.008 to allow for skin friction. Theory may be extrapolated outside its valid limits to Mach Number 1.21; it agrees fairly well, with a tendency for the experimental values to be on the low side.

Flutter and Oscillating Air-Force Calculations for an Airfoil in a Two-Dimensional Supersonic Flow. I. E. Garrick and S. I. Rubinow. *U.S., N.A.C.A., Technical Note No. 1158*, October, 1946. 65 pp., figs. 7 references.

A connected account is given of the Possio theory of nonstationary flow for small disturbances in a two-dimensional supersonic flow and of its application to the determination of the aerodynamic forces on an oscillating airfoil. Further application is made to the problem of wing flutter in the degrees of freedom—torsion, bending, and aileron torsion. Numerical tables for flutter calculations are provided for various values of the Mach Number greater than unity. Results for bending-torsion wing flutter are shown in figures and discussed. The static instabilities of divergence and aileron reversal are examined, as is a one-degree-of-freedom case of torsional oscillatory instability.

Learn to Fly From the Insect. William B. Stout. *Flying*, Vol. 40, No. 1, January, 1947, pp. 34, 35, 64, 66, 68, figs.

Problems of Supersonic Flight. Carl W. Baberger. *Weight Engineering*, Vol. 4, No. 3, Fall, 1946, pp. 14–17, figs.

Some of the problems of supersonic flight, the theory in brief, and some current thought trends that may lead to solutions are presented. It is noted that these problems should be of special interest to weight engineers because weight increases are almost certain to result from their solution.

Full Scale Lift Curve Determination—Boomerang. R. Noble and A. See. *Australia, Royal Australian Air Force, Aircraft Performance Unit No. 1, Laverton, Performance Report, Detail No. 621/46/44*, June, 1945. 12 pp., illus. 4 references.

It was required that the full-scale lift curve of a Boomerang be determined, for correlation with experimental work on stability derivatives. Besides the required lift curve, curves of attitudes for various speeds, and gross weights for straight and level flight and 20° dive conditions are given.

The irregularity of receipt of publications from abroad necessitates the review of articles in issues several months late. This is done to provide readers with information regarding foreign technical progress as soon as the issues are available in the United States.

The views and opinions expressed in this section are exclusively those of the writers or publications named. They are in no case to be construed as those of the Aeronautical Engineering Review or the Institute of the Aeronautical Sciences.

Transonic Speeds in Aircraft. Robert Banks. *Northwestern Engineer*, Vol. 5, No. 4, December, 1946, pp. 12, 13, 22, illus.

A discussion of aerodynamic problems encountered when the velocities of aircraft are in the transonic region. Subjects considered include the creation of shock waves in a Laval nozzle, the effect of sweepback on airfoil shock-wave flow, and the elimination of induced drag in the supersonic region.

Tables and Charts for the Evaluation of Profile Drag from Wake Surveys at High Subsonic Speeds. Myron J. Block and S. Katzoff. *U.S., N.A.C.A., Restricted Bulletin No. L5F15a (Wartime Report No. L-107)*, July, 1945. 40 pp., figs., tables. 3 references.

Flight Investigation at High Mach Numbers of Several Methods of Measuring Static Pressure on an Airplane Wing. John A. Zalovcik and Fred L. Daum. *U.S., N.A.C.A., Restricted Bulletin No. L4H10a (Wartime Report No. L-90)*, November, 1944. 17 pp., illus. 1 reference.

Note on Compressibility Effects on Downwash at the Tail at Subcritical Speeds. Jack N. Nielsen and Harold H. Sweberg. *U.S., N.A.C.A., Confidential Bulletin No. L5C09 (Wartime Report No. L-19)*, March, 1945. 16 pp., diagrs. 8 references.

Flight Investigation at High Speeds of Flow Conditions over an Airplane Wing As Indicated by Surface Tufts. Clotaire Wood and John A. Zalovcik. *U.S., N.A.C.A., Confidential Bulletin No. L5E22 (Wartime Report No. L-91)*, June 1945. 19 pp., illus. 2 references.

Variation with Mach Number of Static and Total Pressures Through Various Screens. Alfred A. Adler. *U.S., N.A.C.A., Confidential Bulletin L5F28 (Wartime Report No. L-23)*, February, 1946. 20 pp., diagrs. 1 reference.

The Relation Between Spanwise Variations in the Critical Mach Number and Spanwise Load Distribution. Richard T. Whitcomb. *U.S., N.A.C.A., Confidential Bulletin No. L4L07 (Wartime Report No. L-182)*, December, 1944. 8 pp., figs. 5 references.

Investigation of Effects of Various Camouflage Paints and Painting Procedures on the Drag Characteristics of an NACA 65(421)-420, $a = 1.0$ Airfoil Section. Albert L. Braslow. *U.S., N.A.C.A., Confidential Bulletin No. L4G17 (Wartime Report No. L-141)*, July, 1944. 19 pp., figs. 1 reference.

Wind-Tunnel Tests of Two Tapered Wings with Straight Leading Edges and with Constant-Chord Center Sections of Different Spans. Richard W. Fairbanks and Sidney R. Alexander. *U.S., N.A.C.A., Advance Restricted Report No. 3J28 (Wartime Report No. L-311)*, October, 1943. 31 pp., figs. 3 references.

Correlation of Flight Data on Limit Pressure Coefficients and Their Relation to High-Speed Burbling and Critical Tail Loads. Richard V. Rhode. *U.S., N.A.C.A., Advance Confidential Report No. L4I27 (Wartime Report No. L-269)*, September, 1944. 33 pp., figs. 9 references.

Effects of Reynolds Number and Leading-Edge Roughness on Lift and Drag Characteristics of the NACA 65_3-418, $a = 1.0$ Airfoil Section. John H. Quinn, Jr. *U.S., N.A.C.A., Confidential Bulletin No. L5J04 (Wartime Report No. L-82)*, November, 1945. 12 pp., illus. 3 references.

Aerodynamic Characteristics of the NACA 747A315 and 747A415 Airfoils From Tests in the NACA Two-Dimensional Low-Turbulence Pressure Tunnel. *U.S., N.A.C.A., Confidential Bulletin No. L4I25 (Wartime Report No. L-156)*, September, 1944. 14 pp., figs. 1 reference.

Wind-Tunnel Investigation of Aileron Effectiveness of 0.20-Airfoil-Chord Plain Ailerons of True Airfoil Contour on NACA 65_2-415, 65_3-418 and 65_2-421 Airfoil Sections. Albert L. Braslow. *U.S., N.A.C.A., Confidential Bulletin No. L4H12 (Wartime Report No. L-178)*, August, 1944. 17 pp., figs. 3 references.

Tests of the NACA 65_3-018 Airfoil Section With Boundary-Layer Control by Suction. John H. Quinn. *U.S., N.A.C.A., Confidential Bulletin No. L4H10 (Wartime Report No. L-209)*, October, 1944. 27 pp., figs. 3 references.

Wind-Tunnel Investigation of NACA 66(215)-216, 66, 1-212, and 65_1-212 Airfoils with 0.20-Airfoil-Chord Split Flaps. Felcien F. Fullmer, Jr. *U.S., N.A.C.A., Confidential Bulletin No. L4G10 (Wartime Report No. L-140)*, July, 1944. 13 pp., figs. 2 references.

High-Speed Wind-Tunnel Tests of the NACA 23012 and 23012-64 Airfoils. John V. Becker. *U.S., N.A.C.A., Advance Confidential Report (Wartime Report No. L-357)*, February, 1941. 14 pp., figs. 8 references.

Wind-Tunnel Investigation of an NACA 23012 Airfoil With a Handley Page Slot and Two Flap Arrangements. Marvin J. Schuldenfrei. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-261)*, February, 1942. 24 pp., figs. 6 references.

Wind-Tunnel Investigation of the Characteristics of Blunt-Nose Ailerons on a Tapered Wing. Paul E. Purser and Thomas A. Toll. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-262)*, February, 1943. 71 pp., figs. 6 references.

Effect of Compressibility on Pressure Distribution over an Airfoil With a Slotted Frise Aileron. Arvo A. Luoma. *U.S., N.A.C.A., Advance Confidential Report No. L4G12 (Wartime Report No. L-266)*, July, 1944. 66 pp., figs. 3 references.

Wind-Tunnel Investigation of a Tapered Wing With a Plug-Type Spoiler-Slot Aileron and Full-Span Slotted Flaps. John G. Lowry and Robert B. Liddell. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-250)*, July, 1942. 28 pp., figs. 8 references.

Pressure Distribution over an Airfoil With a Balanced Split Flap. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-264)*, December, 1941. 21 pp., figs. 10 references.

Drag Measurements of a Protruding 0.50-Caliber Machine Gun. Arvo A. Luoma. *U.S., N.A.C.A., Advance Confidential Report (Wartime Report No. L-348)*, July, 1941. 12 pp., figs.

Air Laws and Regulations

Regulations and the Vitality of Trade. *Interavia* (Geneva), Vol. 1, No. 7, October, 1946, pp. 76, 77, map.

International air routes and the agreements now in course of negotiation between the United States and other nations are discussed in a brief outline of recent progress toward the settlement of world air transport problems.

Facilitation of International Air Travel. H. C. Tarrington. *Air Age Education News*, Vol. 4, No. 3, December, 1946, pp. 5–7. (An address.) Simplification of clearance through customs, immigration, and public health.

For Greater Travel Freedom. *Air-Sea Safety* (Washington), Vol. 1, No. 1, November, 1946, p. 66. (Cf. preceding abstract.)

Air Transport—General

Transport-Cost Precision Via P-S-D Approach. *Aviation*, Vol. 45, No. 12, December, 1946, pp. 103, 106, 107, 122, 123, 126.

Because it was impossible to get true analyses of aircraft economics with "job lot" per hour, per mile, and per ton-mile measures, power-space-density denominators were adopted to obtain efficient and more profitable operations accounting. A work table contains sample specifications and data employed in this approach to economic analysis of aircraft operation. The figures are based on a hypothetic transport plane.

The CAA Goes Overseas; World-Wide Plan Will Aid Globe-Trotting U.S. Pilots Who Make Flights to Foreign Lands. James Lee. *Flying*, Vol. 40, No. 1, January, 1947, pp. 27, 80, map.

"Pacific Ops": The Story of the Military Contract Operations of United Air Lines. *The Intava World*, Vol. 6, No. 4, September, 1946, pp. 74–78, illus.

PICAO at Work. Edward Warner. *Air Transport*, Vol. 4, No. 12, December, 1946, pp. 23–26, 89, illus.

Following a brief review of the activities of the Provisional International Civil Aviation Organization, details are given about the development of regional manuals for air navigation and the arrangements for international support of air-navigation facilities and services.

Present Status of World Air Transport. L. Welch Pogue. *Air Transport*, Vol. 4, No. 12, December, 1946, pp. 31, 32, illus. Some of the accomplishments of the Provisional International Civil Aviation Organization are reviewed, and the subject of multilateral vs. bilateral bargaining is clarified.

The 500 Days of International Air Transport. Sir William P. Hildred. *Air Transport*, Vol. 4, No. 12, December, 1946, pp. 27, 28, illus. A brief review of the progress made by international air transportation since the end of the war.

Australia—Pacific Air "Instrument" for Empire. H. Bowden Fletcher. *Air Transport*, Vol. 4, No. 12, December, 1946, p. 43.

Air Transport, Cargo

The Return Load Problem. John H. Frederick. *Distribution Age*, Vol. 45, No. 12, December, 1946, pp. 34, 44, 53.

Problems of return loads, regulation, and other factors indicate that the usual methods of conducting business followed by the freight forwarder do not appear to be suited to air cargo, especially nonscheduled operations. In recognition of this, two other types of organizations have been introduced recently: (1) a freight-soliciting company that contracts for all the space in the plane, giving a guaranteed minimum; and (2) an air-cargo terminal company that services, loads and unloads planes, and stores and delivers cargo. The requirements necessary to carry out the work properly are enumerated.

Area Patterns for Airfreight Service. (Conclusion.) R. W. Hoecker. *The Pegasus*, Vol. 8, No. 6, December, 1946, pp. 13–16, illus.

Department of Commerce studies of the air-cargo potentials of various areas in the United States and Latin America have established definite patterns for the flow of air cargo from one area to another, indicating the kind and quantity of commodities produced in one section of the country or of the Western Hemisphere for which there is a measurable demand in another section. A plan has been devised for regularly scheduled through air-cargo service, for the delivery of perishable commodities or others in which the time element is a factor of vital economic importance, without intermediate stops to load or unload miscellaneous freight. Flowers, fruits, vegetables, and sea food are among the products suitable for this mode of transport. Statistics are given about air-freight potentials.

Aerocarriage. *Aeronautics*, Vol. 15, No. 5, December, 1946, pp. 75, 76. A discussion of the volume and character of various commodities being shipped by air in different countries, including the United States.

Wartime Headaches Aid Commercial Air Transport. David W. Long. *SAE Journal*, Vol. 54, No. 12, December, 1946, p. 68. (Abstract of an address.)

New Container for Air Shipment of Perishable Products. *Santi-Kraft Corp., Release*, Recd. December 18, 1946. 2 pp.

A new Fiberglas-insulated container is reported capable of maintaining an 80°F. temperature differential for 8 hours without replacement of the refrigerant. Overall dimensions of the container are 4 by 4 by 4 ft. The opening side is fitted with pressure-sealed, rubber-covered zippers to prevent leakage of air into the container. Six pockets in the top of the container hold the slabs of dry ice. In manufacturing the container, 3 in. of Fiberglas insulation and two plies of Vitafilm plastic, which provide a septum for the Fiberglas, are shaped into a cube that is given an inner and outer covering of Fiberglas cloth, neoprene, and aluminum. A table supplied with each container makes it possible to determine the amount of dry ice needed for a given shipment at the desired temperature and refrigeration time.

Distances and Air Freight. Jerry Martin. *Air Transportation*, Vol. 9, No. 5, November, 1946, pp. 22, 24–26, illus. (See AER 9/46:39.)

Air Transport, Nonscheduled

United States Nonscheduled-Contract Air Carriers and Intrastate Airlines. *Air Transportation*, Vol. 9, No. 5, November, 1946, pp. 52–62.

An alphabetical list of the names and addresses of over 800 companies, indicating some of the aircraft types in operation and on order. The list is published at irregular intervals.

Air Transport, Scheduled

Estimating Potential Passengers. Richard H. Rush. *Aero Digest*, Vol. 53, No. 6, December, 1946, pp. 42, 43, charts.

Population, income-tax figures, retail-trade volume, rail traffic, employment figures, industrial activity, and geographic factors are taken into consideration in estimating the potential amount of air-passenger business that can be expected from a given area. These factors are evaluated and charted in order to determine the prospects for establishing new air routes or extending existing routes.

Many Transport Models on International Routes. *Air Transport*, Vol. 4, No. 12, December, 1946, pp. 33–35, map.

The results of a survey, giving the number and type of aircraft in use in the international routes of 20 companies. It indicates that more than 700 aircraft are in service. A map shows the international air routes and their frequencies.

The Airlines . . . And the Public. I. George P. Saunders. *Air Transport*, Vol. 4, No. 12, December, 1946, pp. 46, 49, 51.

Caught in the middle of difficult postwar adjustments, the air lines find they are confronted with a real public relations problem. As an approach to its solution, the writer makes a critical study of some of the things that may be wrong with air lines from the standpoint of public relations, insight, organization, and methods.

New Air Transport Clearing House. *Modern Transport*, Vol. 56, No. 1445, November 23, 1946, p. 7.

The International Air Transport Association meeting at Cairo approved the establishment of a clearing house for the apportionment and settlement of all international interline air-traffic revenue, to facilitate the prompt settlement of transactions, to minimize the risks and costs of foreign-exchange dealings, and for economy in internal administration.

Progress of Air France. *Airports & Air Transportation* (London), Vol. 1(N.S.), No. 42, November, 1946, pp. 248–252, 255–259, illus.

Société Anonyme Belge d'Exploitation de la Navigation Aérienne (Sabena), Brussels. *U.S., Civil Aeronautics Board, Airline Manual, Supplement*, November 15, 1946. 30 pp., maps. 25 references.

In addition to a brief history of the Belgian national air line, the report reviews recent events in connection with the company's operations, outlines the territory served at present, and gives tabulated statistics concerning the routes, connecting and competing air lines, airports, tariffs, equipment, revenues, expenses, and financial condition.

Clippers—In War and Peace. Samuel F. Pryor. *Air Transport*, Vol. 4, No. 12, December, 1946, pp. 39–42, illus. A review of the wartime activities of Pan American World Airways.

KLM . . . From Wartime Coma to Peacetime Expansion. Howard P. Whidden, Jr. *Air Transport*, Vol. 4, No. 12, December, 1946, pp. 36–38, illus. A review of the activities of Royal Dutch Airlines since May, 1945.

Airline Costs—A Rising Tide. *Air Transport*, Vol. 4, No. 12, December, 1946, pp. 68, 69.

Higher payrolls, crew familiarization, and personnel expansion and training for new equipment are held to be contributing factors in the decline of profits.

American Air Transport Through the Magnifying Glass. *Interavia* (Geneva), Vol. 1, No. 7, October, 1946, pp. 34–40, illus.

An analysis of the evolution of American air transport in 1944 and 1945 compared with prewar results. Tables give figures for domestic and international aircraft and passenger mileage from 1927 to 1945, and graphs show the growth of air traffic and the expansion of commercial air services. The average number of passenger seats available per aircraft rose from 6.58 in 1932 to 20.63 in 1945. The greater capacity and increasing size of airplanes are reflected in a comparison of past, present, and future commercial planes. Other figures relate to mail and cargo revenues, operating expenses, and net earnings of the various companies.

Industrial Organisation Has Growing Problems for Nation's Airlines. *Aircraft* (Melbourne), Vol. 25, No. 1, October, 1946, pp. 19–21, illus.

Air Freight Up. *Aircraft* (Melbourne), Vol. 25, No. 1, October, 1946, pp. 25, 40, table. Statistics on Australian regular air-transport service for the year ending June 30, 1946, and comparisons with operations in previous years.

Australia's Plans for Civil Aviation. Arthur S. Drakeford. *Airports & Air Transportation* (London), Vol. 1(N.S.), No. 42, November, 1946, pp. 260, 261.

Polish Air Services; Activities of LOT. *Modern Transport*, Vol. 56, No. 1448, December 14, 1946, p. 7, illus.

Safety and Regularity. *Air Affairs* (London), No. 16, November, 1946, p. 2, illus. Various phases of the question of how much speed British air transport can afford are discussed.

Airline Pilot: The Need for Standardized Qualifications; An Examination of the Present Requirements; Efficiency Essential for Prestige. *Flight*, Vol. 50, No. 1980, December 5, 1946, pp. 618, 619, 631.

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Airplane Descriptions

From the Continent. VII. *Air Reserve Gazette*, Vol. 1, No. 7, December, 1946, pp. 14, 15, 30, illus. The Breguet 730 military patrol flying boat, Danish KZ-II elementary trainer and KZ-IV ambulance and taxi, the Czechoslovakian Letov Ju 290 50-seat transport, and the Spanish Hispano Suiza 42 trainer.

Italian Aircraft Developments, 1942–1946. *The Aeroplane Spotter*, Vol. 7, No. 176, November 30, 1946, pp. 282, 283, illus. Tabulated specifications of 53 military and civil aircraft.

Sold Abroad; Aircraft Which Figure in Britain's Growing Export Trade. *Flight*, Vol. 50, No. 1978, November 21, 1946, pp. 566a–566c, illus.

Skyways Special Aircraft Section. *Skyways*, Vol. 5, No. 12, December, 1946, pp. 38–119, illus. Includes descriptions of over 100 military, naval, transport, and personal models.

Commercial Transport Planes. *Aviation Maintenance & Operations*, Vol. 6, No. 6, November, 1946, pp. 95–116, illus. Specifications and prices of 19 commercial airplanes of 10 American manufacturers, with data on 39 discontinued models and 53 war surplus aircraft.

Personal Planes; Current and New Models for Delivery During 1946–47. *Aviation Maintenance & Operations*, Vol. 6, No. 6, November, 1946, pp. 37–94, illus. Specifications and prices of 52 light airplanes of 38 American manufacturers, with data on 260 discontinued models and 80 war surplus aircraft.

Personal Flying Review of the National Aircraft Show. *Flying*, Vol. 39, No. 6, December, 1946, pp. 67–93, illus. Includes specifications of 42 aircraft and 39 engines.

Private Plane Who's Who Compiled. Franklin F. Page. *National Aeronautics*, Vol. 24, No. 11, November, 1946, pp. 2, 3, 10, 13, 14, illus. Descriptions and selling prices of the airplanes of about 20 American manufacturers.

17me Salon D'Aéronautique. *The Aeroplane*, Vol. 71, No. 1852, November 22, 1946, pp. 613–628, illus. An account of the 17th International Exhibition of Aeronautics, Paris, November 15–December 1, 1946, includes descriptions and specifications of over 40 of the aircraft displayed.

Paris Through the Looking-Glass. T. S. Wade. *The Aeroplane*, Vol. 71, No. 1855, December 13, 1946, pp. 716, 717, illus. The Nord 1101 Noralpha, the Nord 1203 Norecrin, and the Courlis SUC 10.

European Lightplanes Follow Principal American Trends. *Aviation News*, Vol. 6, No. 25, December 16, 1946, pp. 18, 20, illus. Descriptions of some aircraft exhibited at the Paris Aero Show.

Paris Aero Show. *Flight*, Vol. 50, Nos. 1978, 1979, November 21, 28, 1946, pp. 555–561; 594–598, illus.

The Streak. *Aero-Flight Aircraft Corp., Release*, December 10, 1946. 7 pp., illus.

The Streak is a low-wing, tandem, dual-control personal plane of all-metal construction, powered by an 85-hp. Continental engine with direct fuel injection. It has an estimated cruising speed of 150 m.p.h. and range of 700 miles. The level attitude of the retractable landing gear and the good vision resulting from the use of a bubble-type canopy are said to provide unusual ease in taxiing and parking.

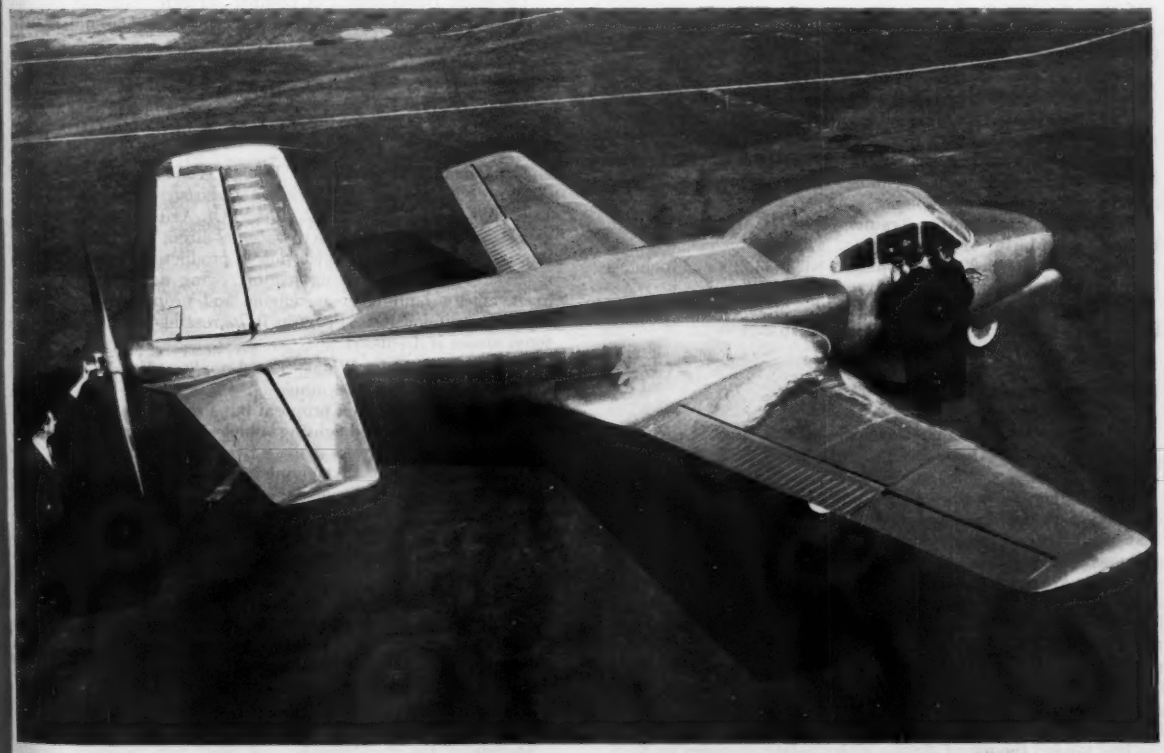
Super Bomber. *Canadian Aviation*, Vol. 19, No. 12, December, 1946, p. 86, illus. The Consolidated Vultee B-36 heavy bomber.

The French Airsedan. *Flying*, Vol. 40, No. 1, January, 1947, pp. 55, 88, illus.

The French Courlis plane is said to resemble the hypothetic postwar private plane suggested in the August, 1945, issue of the magazine *Flying*. The Courlis, developed and now being manufactured by the Chausson factories, is of the high-wing type with twin tail booms, pusher propeller, and tricycle landing gear. Powered by a 198-hp. Mathis G8R engine, it has maximum speed of 155 m.p.h., cruising speed of 137 m.p.h., and lands at 45 m.p.h. The wing loading is 15.6; the power loading, 16.12 lbs. per sq.ft.; range, 745 miles; and gross weight, 3,149 lbs. Specifications and other features are compared with those of the magazine's suggested "Air-sedan."

Douglas Announces New 5-Place Plane. *Douglas Aircraft Co., Inc., Release*, January 3, 1947. 2 pp., illus.

The Douglas Cloudster is an all-metal low-wing monoplane intended for either charter service or executive use. It can carry five persons and 250 lbs. of baggage 950 miles at 200 m.p.h. Maximum range exceeds 1,100 miles. Two 250-hp. Continental engines, mounted inside the fuselage behind the passenger compartment, drive an 8-ft. propeller located aft of the rear control surfaces. Either engine can be cut out without affecting flight



The Douglas Cloudster five-place airplane. (See "Douglas Announces New 5-Place Plane.")

control. Rate of climb is 600 ft. per min. with one engine and 1,500 ft. per min. with both. The service ceiling is 11,800 ft. on one engine and 22,200 ft. with both engines. The wing span is 39 ft. 9⅜ in.; height, 12 ft.; and overall length, 35 ft. 4½ in. Tricycle landing gear (with steerable nose wheel) retracts into the nose and wings. Standard equipment includes electric starters; cabin heating and cooling systems; dual controls; hydraulic landing gear, flaps, and brakes; two-way radio with broadcast receiver; and night-flying instruments.

Concordia. *Interavia* (Geneva), Vol. 1, No. 7, October, 1946, p. 75, illus.

The Cunliffe-Owen twin-engined medium transport for regional and feeder-line operation is of semimonocoque fuselage construction and has seats for ten passengers and the two-man crew. Powered by two Alvis Leonides LE.4M nine-cylinder, air-cooled radial engines of 512 hp. each, driving Rotol three-blade, constant-speed propellers of 9 ft. diameter, a cruising speed of 190 m.p.h. at 60 per cent power is provided. At specified flight conditions an operating cost of 1*s.* 5*d.* per aircraft mile is estimated.

The De Havilland Dove. Roy Cross. *Air Review* (*London*), Vol. 8, No. 1, November, 1946, pp. 21–25, illus. (Cf. AER 1/47:40.) Includes a cutaway drawing.

Salvo! The Navy's AD-1 Skyraider, Douglas Dive Bomber. Chet Miller. *Douglas Airview*, Vol. 13, No. 8, October, 1946, pp. 10, 11, illus.

Reflections on the Fieseler Storch. *The Aeroplane*, Vol. 71, No. 1854, December 6, 1946, p. 693, illus.

The Grumman "Mallard." *Aero Digest*, Vol. 53, No. 6, December, 1946, p. 55, illus. (Cf. AER 1/47:40.)

All-Metal Meyers 125. *Southern Flight*, Vol. 26, No. 6, December, 1946, p. 19, illus. (Cf.AER 7/46:37.)

Morane-Saulnier MS 571. *Interavia* (Geneva), Vol. 1, No. 7, October, 1946, pp. 41, 42, illus. A new French three-seat private plane for touring and sport use is of all-metal, stressed-skin construction, and features folding wings to facilitate storage.

The North American "Navion." *Aero Digest*, Vol. 53, No. 6, December, 1946, pp. 84–86, 89, 122, 153, diagrs. (Cf. AER 5/46:127.)

Design Analysis of the North American Navion. *Release*, with construction drawings, of *North American Aviation, Inc.*, November, 1946.

Percival Prentice. *Aeronautics*, Vol. 15, No. 5, December, 1946, p. 44, illus. (Cf. AER 7/46:37.)

A New Swedish Transport. *The Aeroplane*, Vol. 71, No. 1855, December 13, 1946, p. 725, illus. (Cf. AER 1/47:39.) The Saab 90.

B.O.A.C. Hythe Conversion of Sunderland III. II. *Modern Transport*, Vol. 56, No. 1445, November 23, 1946, p. 19, illus. (Cf. AER 1/47:39.) Includes a description of a new dock planned at Southampton.

Skandinavsk Aero Industri KZ III. *Air Reserve Gazette*, Vol. 1, No. 7, December, 1946, p. 32, illus. Specifications and a brief description of a light monoplane.

The Supermarine Spitfire Trainer MK.VIII; One 1,315 H.P. Rolls-Royce Merlin 66 Aero-Engine. *The Aeroplane*, Vol. 71, No. 1852, November 22, 1946, pp. 611, 632, 633, diagr. Includes a cutaway drawing.

The Waco "Aristocraft." *Aero Digest*, Vol. 53, No. 6, December, 1946, pp. 59, 117, illus. (Cf. AER 11/46:32.)

Airplane Design

Systematic Wing Section Development. George S. Schairer. *Journal of the Aeronautical Sciences*, Vol. 14, No. 1, January, 1947, pp. 51–58, figs.

The designer is confronted by different problems in the choice of airfoils for each airplane type designed. Some of the problems that are faced and some systematic methods for their study are discussed. The properties of sections without supersonic flow or separation are readily predicted. The critical Mach Number can be estimated reasonably well, but the boundaries and characteristics of separated flow are not yet susceptible of estimation. Although these separation problems define the stall, which is of primary importance, experimental methods for determining stalling characteristics are questionable. Physical, structural, and arrangement problems will often define airfoils and their thickness in particular. Aileron and flap problems can have strong effects tending toward the use of airfoils with straight contours on their rear portions.

Static Stability Analysis for Flying Boats and Seaplanes. I. Ernest G. Stout. *Aviation*, Vol. 45, No. 12, December, 1946, pp. 70, 71, figs.

A floating vessel will not remain upright in a state of static equilibrium because it is continually under the influence of external forces, such as wind and waves. Of particular concern to the seaplane designer is the fact that the desired upright, in most cases, is not the position that the hull would normally assume under this condition of equilibrium, and a knowledge of the external forces required to maintain the desired upright is necessary. The forces causing deviations from static equilibrium are analyzed and calculated. Procedures to insure that the static stability of a seaplane will be adequate and safe are detailed. The subject is discussed in sections dealing with important aspects of transverse metacenter, the theorem of transference, and the derivation of the expression for the distance from center of buoyancy to metacenter.

Airline Equipment Weight With Reference to the Establishment of the Airline Operating Weight Empty. F. S. Nowlan and W. W. Davies. *Weight Engineering*, Vol. 4, No. 3, Fall, 1946, pp. 5–9, 39, 40, figs.

An outline of some of the influences that affect the operator's point of view of the compromise that must be made between the maximum possible pay load and other factors, when selecting equipment that finally determines the operating empty weight of the airplane. Much of the weight that air lines add to aircraft at the expense of the maximum pay load has real economic value. The discussion is based on the premise that such weight assists in the sale of air transportation and will increase the average revenue load in the lower load-factor days of the future.

Fuel Volume and Center of Gravity. Frank H. Copeland. *Weight Engineering*, Vol. 4, No. 3, Fall, 1946, pp. 24–27, figs.

Quick methods of obtaining the volume and c.g. of the fuel in tanks of various shapes are given. One tank shape often encountered, especially in fuselage tanks, can be resolved into a frustum of a cone with dished ends that are practically spherical segments. Sometimes the sides of the cone are slightly curved as they follow the streamlining of the fuselage. In such a case the conical part of the tank can usually be approximate within reasonable limits by considering it to consist of several sections, each a frustum of a cone with straight sides. Mathematical solutions of the problems are worked out.

Technical Development of Bomber Aircraft. Marcus Langley and J. J. Gerritsen. *Aeronautics*, Vol. 15, No. 5, December, 1946, pp. 53, 54, 57, 58, 61.

An extensive historical review of British bomber aircraft built during the period from 1916 to 1943. A table of the specifications of the bombers is included. Reference is made to the American approach to certain problems brought about by increased weight and wing loading.

The Personal Airplane. II. Design Trends and Utility. Peter Altman. *Automotive and Aviation Industries*, Vol. 95, No. 11, December 1, 1946, pp. 26–32, illus. (Cf. AER 1/47:43.)

A survey of developments in personal aircraft and the design of representative postwar models now in production. Consideration is given to trends in wing loading, wing arrangement, cabin arrangement, landing gears, engine and propeller installations, and noise elimination. Progress in increasing the utility of personal planes is discussed.

The Baynes Carrier Wing. *The Aeroplane*, Vol. 71, No. 1854, December 6, 1946, p. 692, illus.

Reference is made to a proposal put forward in 1941 by L. E. Baynes that an armored fighting vehicle, such as an 8½-ton tank, could acquire air-borne properties by the attachment of an "all-wing" to the top of it, thus giving it the same characteristics as a towed freight glider. Because there was insufficient knowledge of tailless-aircraft designs, a one-third scale flying model of the full-size project was constructed to prove its aerodynamic and control characteristics. The results of flight tests are described and important specifications of the proposed carrier wing, which never was built, are listed.

Future Flight. S. G. Hooker. *Aircraft* (Melbourne), Vol. 25, No. 2, November, 1946, pp. 36, 38, 54, figs. Particular attention is given to the use of jet propulsion for heavy transport and bomber aircraft.

Design of German Supersonic DM-1. James J. Rodgers. *Aviation*, Vol. 45, No. 12, December, 1946, pp. 78, 79, illus.

Details of the development and flight-test program for the DM-1 reveal how Germany strove to produce a plane that could

pierce the supersonic barrier while also retaining efficiency at subsonic speeds. The development program was divided into three phases. The first model was to have no power plant and it would only indicate whether the chosen configuration would cope with slow speed. The second model was to have jet-power units similar to those of the Me 262 German jet fighter. This model would be used to ascertain characteristics in speed ranges from 500 to 750 m.p.h. The third model was to have a rocket-propulsion unit (similar to Me 163) or a Lorin jet system, with which speeds of 1,215 m.p.h. were considered possible. Design data on this aircraft, which had a wing with a 60° sweepback of the leading edge and a 15° sweep forward of the trailing edge, are listed.

Handley Page Research Into Tail-Less Flight. *Handley Page Bulletin*, Vol. 12, No. 141, November, 1946, pp. 2, 3, 6, illus.

Current results of British research prove that the mere application to present-day basic aircraft of the gas turbine, jet propulsion, and other developments brought out during and since the war are not sufficient to measure future possibilities. Greater speeds and more comfortable flying will be achieved by new designs now in progress, including those involving tailless aircraft. Progress made by the Handley Page organization in the development of tailless aircraft in recent years is traced, with an outline of the advantages of that type and a description of the Manx.

Integral Stiffening Saves Time, Parts, and Tools. *Aviation*, Vol. 45, No. 12, December, 1946, pp. 98, 99, illus.

Stiffening features, formed into a radio access door as an integral part of a Glenn L. Martin Company design, eliminated many small riveted clips, gussets, ribs, and other details, but the construction was not feasible for prototype design because of the small quantity required, the lack of time, and the necessity for using forming discs. The problem was solved by an improved design in which a stiffening sheet was formed and spot-welded to the flat sheet. Tools used in development of the new-type door consisted of two sets of drop hammer dies, each made up of an upper and a lower unit. The extra stiffness of the improved design permitted the doors to be made of magnesium sheet instead of aluminum with a resultant saving in weight. Hints on the application of integral stiffening to doors are included.

Getting a Lift Without a Drag. William S. Friedman. *Air Force*, Vol. 29, No. 11, December, 1946, pp. 42–44, 62, illus.

A review of the merits and possibilities of the lifting or airfoil-section fuselage developed by Vincent J. Burnelli. Safety advantages of the flying-wing theory are discussed, and some particulars are given about the CBY aircraft incorporating this principle, which will be built for 3,000-mile ocean trips carrying up to 72 passengers, depending on the cargo-baggage proportion. Recent developments in wing design which have enhanced the future possibilities of the lifting fuselage are described.

Float Structure Redesign Simplifies Output and Maintenance. *Aviation*, Vol. 45, No. 12, December, 1946, pp. 74, 75, illus.

The Edo Aircraft Corp. has simplified the internal structure and eliminated difficult-to-fabricate compound curves in personal-plane floats. The methods, which are applicable to many aircraft structures, result in lighter, lower-cost units.

Parasite Fighters; Long-Range Bombers in Future Wars Will Be Protected by Fighters Carried Directly into Battle. Douglas J. Ingells. *Air Trails*, Vol. 27, No. 4, January, 1947, pp. 44, 45, 110–114, illus.

Aircraft for 'Flat-Tops'. I. *Air Affairs* (London), No. 16, November, 1946, pp. 3, 4, illus. The trend in the development of carrier-based aircraft, with particular attention to American, British, and Japanese planes.

New Aircraft Accessories, Equipment and Supplies. *Aviation Maintenance & Operations*, Vol. 6, No. 6, November, 1946, pp. 138 ff. (26 pp.), illus. Descriptions of some 70 items.

Light Aircraft Floats (Fleet Mfg. & Aircraft Co., Ltd.). *Aircraft and Airport*, Vol. 8, No. 10, November, 1946, pp. 46, 48, illus. Descriptive.

The World's Distance Record. John W. Morrison. *Flight*, Vol. 50, No. 1978, November 21, 1946, p. 562, diagr. Recommendations for increasing the range of the Airspeed AS57 to 12,500 miles, redesigning the fuselage, and making other modifications.

Great Planes of the War. II—Republic P-47. *Air Force*, Vol. 29, No. 11, December, 1946, pp. 25–29, illus.

Service Aircraft Evolution. VI—Halifax. J. W. R. Taylor. *Air Review* (London), Vol. 8, No. 1, November, 1946, pp. 38–41, illus. A review of the design and performance of the Halifax bomber, and its role in World War II.

Evolution and Design of the XFD-1 Phantom. I. *McDonnell Airscoop*, Vol. 6, No. 18, December 20, 1946, p. 2, illus.

That Cargoliner 230. *Air Transportation*, Vol. 9, No. 5, November, 1946, pp. 38, 51, illus. (Cf. AER 9/46:40.) The Douglas DC-4.

Preparing for the Brabazon I. *Flight*, Vol. 50, No. 1978, November 21, 1946, pp. 575, 576. (Summary of an address.)

Fitment of 250 Lb. Bomb Racks—Boomerang Aircraft. II. W. J. Bolitho. *Australia, Royal Australian Air Force, Aircraft Performance Unit No. 1, Laverton, Armament Report, Detail No. 510/46/40*, July, 1945. 8 pp., illus.

The Design of the Optimum Hull for a Large Long-Range Flying Boat. John B. Parkinson. *U.S., N.A.C.A., Advance Restricted Report No. L4I12 (Wartime Report No. L-282)*, September, 1944. 41 pp., figs. 7 references.

Tailless Problems: Tip-Stalling a Serious Trouble, But Not the Only One. G. H. Lee. *Flight*, Vol. 50, No. 1979, November 28, 1946, pp. 592, 593, diagr. (Abstract of an address.)

A Correlation of the Dimensions, Proportions, and Loadings of Existing Seaplane Floats and Flying-Boat Hulls. Fred W. S. Locke, Jr. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. W-41)*, March, 1943. 20 pp., figs. 4 references. Data on 75 flying boats and 23 seaplanes.

An Analysis of the Fatigue Life of an Airplane Wing Structure Under Overload Conditions. Abbott A. Putnam and Thomas D. Reisert. *U.S., N.A.C.A., Restricted Bulletin No. L5 K29 (Wartime Report No. L-10)*, February, 1946. 7 pp., figs. 2 references.

Airports and Airfields

Installation of New Elevated High-Intensity Runway Lights. *Air Transport Assn. of America, Release*, December 17, 1946. 2 pp.

A recent decision of the Civil Aeronautics Administration permits construction of runway-lighting systems using elevated lights instead of flush runway lights. Such lights, installed along three runways at Boston and in course of installation at other cities, produce an intense beam exceeding 100,000 c.p., and together with other landing aids provide assistance to aircraft approaching in fog, snow, or rain. In clear weather, runways can be seen from all positions around the airport because the lights are visible from all directions. The new system qualifies under the amended C.A.A. instructions which call for high candlepower marker lights similar in mass and overall dimensions and having a maximum height of 30 in. above runway levels.

High-Intensity Lights Aid All-Weather Flying. Amos L. Lewis. *Air-Sea Safety* (Washington), Vol. 1, No. 1, November, 1946, pp. 11–15, illus.

The development of airport lighting equipment is traced, with particular reference to the Bartow lights used by the Navy. Favorable comments by naval officers about the lights as used in the Aleutians are quoted.

Airport Management. (Continued.) *Airports & Air Transportation* (London), Vol. 1(N.S.), No. 42, November, 1946, pp. 284, 285.

Operation of an airport as a public institution is further discussed in sections dealing with airport personnel, accounting systems, fire extinguishing equipment, revenue producing facilities, and airport income.

Aircraft—Tie Down. *Aero Digest*, Vol. 53, No. 6, December, 1946, pp. 69–71, illus. Mooring methods recommended by the Mutual Aircraft Conference.

Airport Profits Aren't Always in Figures. Ed Nilson. *Southern Flight*, Vol. 26, No. 6, December, 1946, p. 30. The reason why it is important for the airport manager to consider the airport also as a community asset and public utility.

How to Plan Your Community Airport. III—Management. Robert J. Burns. *Aircraft and Airport*, Vol. 8, No. 10, November, 1946, pp. 59, 60.

Need for Revision in Federal Aid Regulations. Kendall K. Hoyt. *Southern Flight*, Vol. 26, No. 6, December, 1946, pp. 26, 27.

A review of the reactions following the recent C.A.A. hearings on proposed regulations for the Federal-aid airport program.

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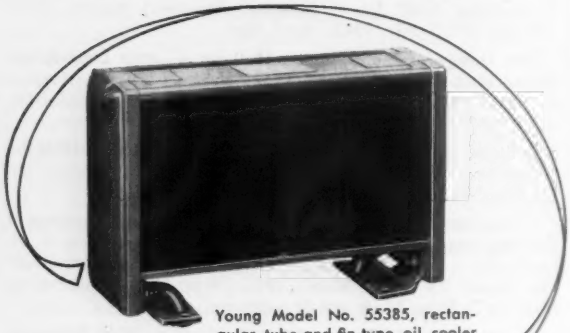
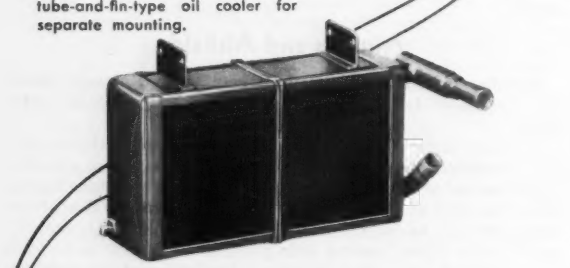


Young Model No. 55385, rectangular tube-and-fin-type oil cooler for mounting on engine block.

Model No. 54692, rectangular tube-and-fin-type oil cooler for separate mounting.



With the "future" of personal airplanes so dependent upon safe, economical operation combined with minimum cost, the new Young rectangular tube-and-fin-type oil cooler is hailed by plane manufacturers and owners alike as an important contribution toward meeting such requirements. These new coolers are 50 percent lighter, 75 percent less costly than the conventional round cellular-type aircraft oil cooler. Models available have capacities to properly cool engines from 75 to 220 H.P. size. Construction details include: provision for thaw-out; internal agitation; designed cores for maximum heat transfer at minimum weight.

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Some suggestions for important changes in the proposed regulations are given.

The Public Still Has to Be 'Sold.' John H. Frederick. *Southern Flight*, Vol. 26, No. 6, December, 1946, p. 28. It is suggested that taxpayers will show more airport interest and support if acquainted with the problems and requirements of aviation progress.

Include Airports in Area Zoning Plan, Official Says. William Conover. *National Aeronautics*, Vol. 24, No. 11, November, 1946, pp. 4, 5.

A discussion of the protection of airport approaches by incorporating airport zoning regulations into city and county comprehensive zoning ordinances. Some of the potential advantages and disadvantages of the proposed method are set forth.

We Need Specialized Airports; A Plan to Develop Separate Airfields for Passenger Planes, Cargoplanes, and Personal Aircraft. Gene Kropf. *Air Transportation*, Vol. 9, No. 5, November, 1946, pp. 7, 8, 10, 11, illus.

Selecting a Site for a Seaplane Base. Robert S. Fogg. *Aviation Maintenance & Operations*, Vol. 7, No. 1, December, 1946, pp. 24, 25, 84, illus.

Four important considerations are: proper economic location; adequate water area and ground space; adequate access to utilities; community cooperation and reaction to the project. An analysis is made of these considerations from the standpoint of long-range operations.

New Marine Turntable Ramp Boosts Seaplane Base Utility. *Aviation*, Vol. 45, No. 12, December, 1946, pp. 82, 83, illus.

Brief details of a retractable ramp for rapid beaching and launching of seaplanes with one-man operation. Essentially, the device is a ramp with turntable platform on an electrically operated cable car mounted on an inclined marine railway.

Airport Merchandising. Gilbert C. Close. *Western Flying*, Vol. 26, No. 12, December, 1946, pp. 28, 29, 40, illus.

Radiant Heat for Hangars. *Aero Digest*, Vol. 53, No. 6, December, 1946, pp. 64, 157, illus.

New Airport Accessories, Equipment and Supplies. *Aviation Maintenance & Operations*, Vol. 6, No. 6, November, 1946, pp. 139 ff. (15 pp.), illus. Descriptions of about 40 items.

New Underwing Plane Refueling to Cut Time 50 Percent. *Shell Oil Co., Inc., Release*, December 20, 1946. 3 pp., illus.

Delivering fuel to each tank at rates up to 250 gal. per min., the underwing method can fill the tanks of large airplanes which hold up to 14,000 gal. of fuel in a little over 15 min. Fuel remaining in the hose after delivery is withdrawn into the truck, so that there is no spillage. To help control static electricity, an electronic control device immediately stops delivery and empties the hose if the ground circuits of either the truck or plane are accidentally disconnected during delivery.

The New Airport Gasporter. *Engineering Research Associates, Inc., Release*, Recd. December 17, 1946. 4 pp., illus.

A mobile fuel dispenser and service unit for light and medium aircraft has a three-way valve for plane defueling, for replenishing tanks, and for fuel transfers, and an automatic shut-off nozzle. There is a compartment for carrying oil and accessories. The dispensing equipment is operated by power take-off from the truck engine. The equipment includes a 25 gal.-per-min. capacity, power-driven pump; air eliminator and meter; 10-ft. hose; discharge line equipped with safety overflow nozzle. Tank capacity is 200 gal.

This Heath Row Business. John W. R. Taylor. *Air Review* (London), Vol. 8, No. 1, November, 1946, pp. 6–8, illus.

An outline of the progress that is being made in the development of London's Heath Row Airport. Expected to take about 8 years to complete, the airport is now handling up to 50 aircraft per day on scheduled flights.

Evansville, Ind., Community Airport Program Sets a Pattern. *Aero Digest*, Vol. 53, No. 6, December, 1946, pp. 48–52, illus.

Airpark by Law; A City Ordinance Gave Eugene, Ore., a New Airpark and a Unique Means of Operating It. Dewey F. Ray. *Flying*, Vol. 40, No. 1, January, 1947, pp. 46, 47, 78, illus.

Roberts Field, Birmingham, Ala. Edith Wideman. *Southern Flight*, Vol. 26, No. 6, December, 1946, p. 29, illus. Descriptive.

Gateway to Europe. Joe Holliday. *Canadian Aviation*, Vol. 19, No. 12, December, 1946, pp. 73, 74, 88, illus. Descriptions of Gander Airport and other airports in Newfoundland.

Airways and Traffic Control

Radio Aids to Navigation. D. M. Stuart. *Paper presented at I.A.S. 15th Annual Meeting*, New York, January 28–30, 1947. (For abstract see "I.A.S. Briefs" on page 26 of this issue, February, 1947.)

Aids to Air Navigation. T. P. Wright. *Aeronautical Engineering Review*, Vol. 5, No. 12, December, 1946, pp. 25–29.

In an address delivered during the National Air Transport Meeting under the joint sponsorship of the I.A.S. and the Institute of Navigation, the Administrator of the C.A.A. reviewed the development of airway marking. He traced the evolution of navigation aids from the first installations of lighted airways, the installation of radio ranges, low-frequency and high-frequency marker beacons, air-traffic control centers, aircraft communication systems, the C.A.A. instrument-landing system, Ground Controlled Approach (G.C.A.), radar, and loran. Services presently rendered include air navigation, traffic control, weather information, and operational information. Plans for the future involve the use of V.H.F. omnidirectional ranges, supplemented by the distance indicator for comparatively short flights on and off the airways; high-powered low-frequency omnidirectional ranges for long great-circle, high-altitude flights; and the C.A.A. instrument-landing system supplemented by G.C.A. and radar at large terminal airports. Other aids will be installed as they are developed and proved to be suitable, search radar being planned for important traffic-control towers.

The Problems of Blind Landing. H. C. Pritchard. *The Royal Aeronautical Society, Journal*, Vol. 50, No. 432, December, 1946, pp. 935–958, Discussion, pp. 958–973, illus. 5 references.

Following a review of existing methods of "blind" approach, the flight control problem and some suggested methods of position fixing are discussed. The problems of blind landing comprise that of defining the aircraft's position relative to the runway, and that of controlling the aircraft from the positional information. It is concluded that the position-fixing problem is unlikely to be solved for the purpose of landing solely by beam or ground control systems, such as have been used for blind approach, although a centimetric beam system may lead to an appreciable and worthwhile advance for approach purposes. The provision of adequate information for vertical guidance appears to be the most difficult landing problem, and some form of radio altimeter the most promising solution. The use of automatic controls to assist the human pilot in controlling the aircraft on the approach track should ease his task considerably, and the application of this conception to the landing maneuver deserves investigation.

Spurious Responses in Spaced-Pulse Coding of Airborne Transponders for Air Traffic Control. William A. Hosier. *Airborne Instruments Laboratory, Inc., Report No. 506-2*, September, 1946. 20 pp., figs.

Methods depending wholly on radar and radar beacon techniques are satisfactory for securing range and bearing information. To provide altitude information at long ranges with usable accuracy, many proposed air navigation and traffic-control systems include provision for obtaining altitude measurement in the aircraft (by barometric altimeter) together with transmission of this information for automatic position indication. Under specified conditions there is one inherent source of error which is not a simple limitation on accuracy but which may produce totally false altitude indications. When two (or more) aircraft at the same azimuth are sufficiently close together in slant (measured) range, regardless of altitude, the two sequences of returned pulses may overlap in such a way as to become indistinguishable by the receiving and interpreting equipment. In such a case, the combined sequence will be interpreted to yield an altitude reading that corresponds to neither of the responding aircraft. This report determines, analytically, the frequency of occurrence of such spurious indications for some representative types of pulse sequences under various conditions, and considers means for minimizing the difficulty.

An Analysis of the Problem of Aircraft Collision Prevention. Richard N. Close. *Airborne Instruments Laboratory, Inc., Report No. 508-1*, September, 1946. 28 pp., figs.

Section I discusses the factors involved in an eventual solution of the collision-warning problem by electronic methods, centering about a device capable of eliminating all preventable collisions, including those arising from accidental causes. Section II attempts to evaluate presently proposed systems of collision prevention in light of the requirements outlined. Section III deals with the problem of an interim collision-prevention device to reduce in part the hazards resulting from presently inadequate navigation and traffic-control techniques.

Radar As an Interim Aid to New York Air Traffic Control. C. A. Fowler, H. B. Abajian, and G. C. Comstock. *Airborne Instruments Laboratory, Inc., Report No. 512-1*, August, 1946. 32 pp., figs.

The restrictions on air-traffic flow in the New York area with two major civil air terminals in operation are: the slow landing rate of the approach-control systems, necessary regulations governing take-offs, the frequent presence of emergency aircraft in the area, and the interaction of traffic departing from, or going to, the two airports. The effect of these restrictions could be lessened considerably with the addition to the various control agencies of accurate and continuous positional information on the aircraft involved. Such information could be obtained by providing search and height-finding radars at or near Newark and LaGuardia airports. With the opening of a third major civil airport in this area, the traffic interaction will increase to such a point that instrument-flying traffic flow will probably be no greater than it was with two airports. The traffic limitations imposed by the interaction can be avoided by using the third airport for north- and south-bound traffic only. They can be considerably relieved by the establishment of a centralized Approach Zone Agency responsible for traffic control in the entire area.

AAF Participates in Joint All-Weather Flying Tests. *War Dept., Public Relations Div., Press Section, AAF, Release*, December 8, 1946. 4 pp.

Results of a joint experimental and research project to test landing aids under adverse weather conditions, conducted by the Army Air Forces, the Navy Bureau of Aeronautics, and the C.A.A. indicate that the most reliable method for landing aircraft under conditions of low visibility would involve the use of three different landing aids. Those aids include either the Instrument Landing System or the Ground Control Approach as the backbone of the integrated system; a system of high-intensity approach and runway lights to aid in establishing visual contact with the runway; and high-pressure fog-dispersal equipment to insure visual contact with the runway under heavy fog conditions.

Collier Trophy Award to Alvarez Spotlights GCA Development. William Kroger. *Aviation News*, Vol. 6, No. 25, December 16, 1946, pp. 7, 8, diagr.

The features and development of the Ground Control Approach system are reviewed. Extracts from a recently published Army Air Forces report indicate that G.C.A. gives a better alignment with the runway than can be achieved with the instrument landing system.

Air Traffic Control. J. P. Chaplin. *Airports & Air Transportation* (London), Vol. 1(N.S.), No. 42, November, 1946, pp. 262, 263.

Aerial Traffic Cops. James L. H. Peck. *Air Trails*, Vol. 27, No. 4, January, 1947, pp. 36–38, 89–93, illus.

The work of the C.A.A. Air Traffic Control in preventing excessive congestion in the air lanes over New York is reviewed. New airways systems between Washington and New York, and between Boston and New York, were laid out to relieve air traffic conditions.

Experiments at Arcata Project Bring All-Weather Landings Near Reality. *United Air Lines News*, Vol. 15, No. 12, December, 1946, pp. 4, 7, illus.

A Pilot's Best Friend Isn't His Mother. *Air Reserve Gazette*, Vol. 1, No. 7, December, 1946, pp. 4, 5, 30, figs. Ground controlled approach.

Radar Aids. W. H. Kennett. *Air Reserve Gazette*, Vol. 1, No. 7, December, 1946, pp. 21, 22.

Electronic Traffic Control: Navar, Navaglobe, Navaglide and Navascreen Apply Radar to the Problem of All-Weather Flight Operation. *Air Force*, Vol. 29, No. 11, December, 1946, pp. 52, 53, 64, figs.

Some Applications of Radar to Civil Aviation. Victor D. Burgmann. *Aircraft* (Melbourne), Vol. 25, No. 2, November, 1946, pp. 16–18, 48, illus.

Bibliography

Aviation Engineer, Take Note! Albert A. Arnhym. *Aero Digest*, Vol. 53, No. 6, December, 1946, pp. 25, 167, 186.

The Air Documents Division of the Air Matériel Command is cataloging an estimated 80,000 engineering documents captured

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Index to Articles in "Astronautics" Nos. 1–60 (June, 1930–December, 1944). *American Rocket Society, Journal*, No. 68, December, 1946, pp. 41–46.

Business and Finance

The Financial Situation of the Aircraft Manufacturing Industry, 1937–1945 (With a Brief Appraisal of 1946). *Aircraft Industries Assn. of America, Inc., Release No. Stat-76*, December 20, 1946. 4 pp., tables.

The report brings up to date the financial history of the industry discussed in detail in chapter four of *Aviation Facts and Figures, 1945*. The adjustment period was not over by the end of 1945 but will also be reflected in 1946 reports. Contract termination claims were settled speedily and fairly. Carry-back tax refunds, unused excess profits credits, and reserves for contingencies and postwar adjustments helped to offset the effects of drastic shrinkages and of reconversion costs. Net sales of the twelve companies studied fell 31 per cent to slightly below $4,000,000,000. Net profits (both before and after contingencies) were about 1.6 per cent of sales. The working capital position of the twelve companies was strengthened during the war. Net sales during 1946 for the twelve companies fell from $4,000,000,000 to about $550,000,000. This represents a shrinkage of more than 90 per cent since 1944. The lowest point in industry activity was reached early in the year. Since then employment and sales have been increasing steadily but slowly.

Aircraft Industry's Biggest Peacetime Year—1946. Robert McLarren. *Automotive and Aviation Industries*, Vol. 95, No. 12, December 15, 1946, pp. 26–29, figs.

A review of general trends, production, shortages, and the financial situation. Charts show the amount and value of products and the number of employees. Figures giving the value of 1946 output and current orders are tabulated.

War Wings for Peace. *U.S., War Assets Administration, Division of Information*, November 1, 1946. 29 pp., illus.

The uses to which war-surplus aircraft have been put are reviewed, with information concerning the new business enterprises and growing employment opportunities that have resulted from the sale of such surplus equipment to veterans and other individuals and companies.

12 Musts for Sales Training. V. C. Rasmussen. *Aviation Maintenance & Operations*, Vol. 7, No. 1, December, 1946, pp. 30, 80–84.

Canadian Aviation in Review, December, 1946. *Canadian Aviation*, Vol. 19, No. 12, December, 1946, pp. 43–61, illus.

Comfort in Aircraft

Quieter Lightplanes. *Weight Engineering*, Vol. 4, No. 3, Fall, 1946, pp. 30–34, illus.

Consideration is given to the reduction of the noise level within the airplane by the use of lightweight sound-deadening materials, and the reduction of engine noise through the use of efficient mufflers.

Must Flying Be a "Racket"? Alexander Klemin. *Scientific American*, Vol. 175, No. 6, December, 1946, pp. 255–257, illus. Means of overcoming objectionable noise created by aircraft in flight are reviewed.

Seat Comfort. Francis E. Randall. *Mechanical Engineering*, Vol. 68, No. 12, December, 1946, pp. 1056–1058, fig.

The theory of seating, causes of fatigue, and elimination of discomfort in aircraft are discussed. The method of seating analysis developed by W. E. Lay and L. C. Fisher, which makes use of an instrument termed the universal test seat, is reviewed. Basic principles determined from tests with this equipment are stated.

How to Dress an Airliner. J. Davis Scott. *Flying*, Vol. 39, No. 6, December, 1946, pp. 64–66, 152, illus. The design of passenger cabins.

Control Systems

Effect of a Geared Tab Upon Mass Parameters of Control Surfaces. James A. Crabtree. *Weight Engineering*, Vol. 4, No. 3, Fall, 1946, pp. 21–23, figs.

A method is presented for determining the effect of deboost tabs on the moment of inertia of an elevator. The method was originally developed for a case in which the elevator had full-length deboost tabs of considerable chord.

Physical Properties of Steel Control Cable With Nearly Same Expansion Rate as Aluminum Alloy. C. W. Meyers. *Automotive and Aviation Industries*, Vol. 95, No. 12, December 15, 1946, pp. 44, 45, 62, 64, figs.

A difficult problem encountered in designing airplane control systems has been that of compensating for the difference in the rate of contraction at low temperatures between the steel control cables and the aluminum-alloy frame of the plane. During the war a flexible steel airplane-control cable was produced having a coefficient of linear expansion approximately equal to that of the aluminum-alloy air frame. The use of this cable was limited to warplanes where control response had to be instantaneous at operation in temperatures which varied from —70 °F. to 100 °F. or more. An investigation by the American Steel and Wire Co. disclosed that a steel analysis existed which had a coefficient of expansion similar to that of aluminum. This steel, however, had not been found amenable to cold drawing into wire. After 2 years of laboratory and plant development, a process was developed which solved the wire-drawing and heat-treatment problems involved. Charts and tables give the physical properties of the cable.

New Ideas in Control. Roger Tennant. *Air Reserve Gazette*, Vol. 1, No. 7, December, 1946, pp. 28, 29, illus. Two-control and V-tail systems.

Tabs and Trim. James Hay Stevens. *Air Reserve Gazette*, Vol. 1, No. 7, December, 1946, pp. 26, 27, figs. The evolution of adjustable, trimming, balance, servo, and spring tabs.

Torque Motor for 'Servo' and Other Applications. Scophony Ltd. *Journal of Scientific Instruments*, Vol. 23, No. 11, November, 1946, pp. 273, 274, diagr.

Two undesirable features of orthodox torque motors, namely, lack of instantaneous starting and the tendency to considerable overrun, caused by the inertia of the rotating mass and the use of antifriction bearings, are claimed to have been overcome in the Scophony torque motor. The conventional principle of rotating a driving member such as an armature or rotor in antifriction bearings is replaced by a gyratory motion of a low-inertia armature.

The New Lear Friction Drive. *Aero Digest*, Vol. 53, No. 5, November, 1946, p. 170, illus. (Cf. AER 9/46:45.)

Effect of Spring and Gravity Moments in the Control System on the Longitudinal Stability of the Brewster XSBA-1 Airplane. William H. Phillips. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-263)*, April, 1942. 23 pp., figs. 1 reference.

Wind-Tunnel Tests of Spoilers on Tail Surfaces. Robert B. Liddell. *U.S., N.A.C.A., Advance Restricted Report No. L5F28 (Wartime Report No. L-260)*, August, 1945. 100 pp., figs. 7 references.

Effect of Elevator-Profile Modifications and Trailing-Edge Strips on Elevator Hinge-Moment and Other Aerodynamic Characteristics of a Full-Scale Horizontal Tail Surface. Carl F. Schueller, Peter F. Korycinski, and H. Kurt Strass. *U.S., N.A.C.A., Confidential Bulletin No. L5F01 (Wartime Report No. L-111)*, June, 1945. 35 pp., illus. 3 references.

Wind-Tunnel Tests of a Piston-Type Control Booster on an Airfoil and Aileron Model. J. D. Bird and Robert A. Mendelsohn. *U.S., N.A.C.A., Restricted Bulletin No. 3K15 (Wartime Report No. L-494)*, November, 1943. 16 pp., figs.

Use of Variable-Ratio Geared Tabs to Improve Stick-Force Characteristics in Turning Flight. Harold F. Kleckner. *U.S., N.A.C.A., Restricted Bulletin No. L5I05 (Wartime Report No. L-85)*, October, 1945. 11 pp., diagrs. 1 reference.

An Approximate Determination of the Power Required to Move Control Surfaces as Related to Control-Booster Design. Harold I. Johnson. *U.S., N.A.C.A., Restricted Bulletin No. L5F27 (Wartime Report No. L-102)*, September, 1945. 16 pp., figs.

The Use of Geared Spring Tabs for Elevator Control. William H. Phillips. *U.S., N.A.C.A., Restricted Bulletin L5A13 (Wartime Report No. L-80)*, February, 1945. 25 pp., diagr. 2 references.

An Automatically Variable Control Linkage and Its Effect on the Lateral-Control Characteristics of a High-Speed Fighter Airplane. Harry E. Murray and Clarence L. Gillis. *U.S., N.A.C.A., Restricted Bulletin No. L4E23 (Wartime Report No. L-65)*, May, 1944. 17 pp., diagrs.

Maximum Rates of Control Motion Obtained From Ground Tests. De E. Beeler. *U.S., N.A.C.A., Restricted Bulletin No. L4E31 (Wartime Report No. L-100)*, May, 1944. 14 pp., illus. 3 references.

Calculation of Stick Forces for an Elevator With a Spring Tab. Harry Greenberg. *U.S., N.A.C.A., Restricted Bulletin No. L4F07 (Wartime Report No. L-129)*, June, 1944. 21 pp., figs. 3 references.

Directories

Roster of Active Members (of the American Rocket Society), Oct. 15, 1946. *American Rocket Society, Journal*, No. 68, December, 1946, pp. 17–22.

Education, Training, and Occupations

The Effectiveness of Directed Attention to Instruments as a Training Aid. R. Y. Walker, S. Wapner, D. Bakan, and E. S. Ewart. *U.S., Civil Aeronautics Administration, Division of Research, Report No. 69*, October, 1946. 34 pp., figs.

One group of student pilots was given the usual type of flight training, while another group was given special training in which reference to the ball bank, the air-speed indicator, and the altimeter was emphasized during instruction in the straight climb and medium turn maneuvers (180° turn, 45° bank). The evidence indicates that the method of directing special attention to instruments is no more effective, and possibly less effective, as a training technique than the more usual methods, although that conclusion is qualified by the lack of evidence regarding the thoroughness of the instruction in the experimental method. Analysis of the data yielded valuable supplementary findings with regard to the preparation of future investigations of this type.

Air University. David M. Schlatter. *Air Force*, Vol. 29, No. 11, December, 1946, pp. 48, 49, illus. The organization of the A.A.F. Air University.

Research in England. Joan Bradbrooke. *Aircraft* (Melbourne), Vol. 25, No. 1, October, 1946, pp. 31, 32, 54, illus. The organization and activities of the College of Aeronautics, Cranfield (England).

Flying Cockpit. *Southern Flight*, Vol. 26, No. 6, December, 1946, p. 23, illus.

An electronically operated flight trainer developed by the Curtiss-Wright Corporation accurately simulates the flight characteristics of the AT-6, and of any aerobatic maneuver. It is equipped for full instrument, radio-range, and blind-landing instruction.

'Tronic Trainer. *Air Force*, Vol. 29, No. 11, December, 1946, p. 51, illus. Description of the Curtiss-Wright Dehmel flight trainer.

Naval Training-Type Epidiascope for Universal Projection of Solid Objects. Jacques Bolsey. *Society of Motion Picture Engineers, Journal*, Vol. 47, No. 5, November, 1946, pp. 418–425, illus.

A new type of projector was designed to project the image of a solid model airplane on a spherical screen. It permits the attitude of the airplane to be varied at will; allows full freedom in pitch, roll, and turn, so that the airplane appears to climb, dive, and roll. The image is variable in size in order to simulate changes in range.

Maintenance and the Future. Winston C. Castleberry. *Air Force*, Vol. 29, No. 10, November, 1946, pp. 54–57, illus. Positions in aircraft maintenance.

One Man One Plane. *Air Force*, Vol. 29, No. 10, November, 1946, pp. 40, 41, illus. Careers in skywriting, sign-towing, and agriculture.

Aviation's Corner Store. *Air Force*, Vol. 29, No. 10, November, 1946, pp. 30–33, 65, illus. Positions in retailing services and supplies to civil aviation.

Time-Table Operators. John S. White. *Air Force*, Vol. 29, No. 19, November, 1946, pp. 26–29, illus. Positions in scheduled air transport.

Uncle Sam's Civilian Air Force: U.S. Civil Service Offers Veterans Lifetime Employment If They Have What Is Needed. William S. Friedman. *Air Force*, Vol. 29, No. 10, November, 1946, pp. 18–20, illus.

How to Choose Your Flight Instructor. A. H. Knouff. *Southern Flight*, Vol. 26, No. 6, December, 1946, pp. 14, 15, 47, illus.

Electrical Equipment

A.C. and D.C. Power Developments on Aircraft. B. Pringle and V. A. Higgs. *Aeronautics*, Vol. 15, No. 5, December, 1946, pp. 46–48, illus.

The merits of d.c. and a.c. electrical systems are discussed, and the experience of the British Thomson-Houston Company, Ltd., in the manufacture of aircraft electrical equipment to meet particular conditions, such as the operation of radar equipment, is cited. The view is expressed that the peculiar merits of each system are such that both will persist, and in most cases, even on the same aircraft.

Cycle-Testing Laboratory for Aircraft Batteries. *U.S., National Bureau of Standards, Release No. ES-1023*, Recd. November 29, 1946. 6 pp.

Equipment installed in a new battery-research laboratory constructed at the National Bureau of Standards with the cooperation of the Navy Bureau of Aeronautics provides for discharging the batteries through constant resistance and recharging them either at constant potential or at constant current, as desired. The cycling may be performed automatically for batteries under conditions of room temperature, extreme heat, sub-zero temperatures, and vibration simulating that encountered in flight. Six similar cycling units have been installed, each operated independently by a master electric clock. Each unit consists essentially of a control cabinet, two motor-generator sets, and the necessary resistors. From one to six 24-volt batteries may be cycled on each unit.

Engine Parts and Accessories

Critical Speeds of Shafts Under Torque. Reinhardt M. Rosenberg. *Paper presented at I.A.S. 15th Annual Meeting*, New York, January 28–30, 1947. (For abstract see "I.A.S. Briefs" on page 27 of this issue, February, 1947.)

A New Rigidity Formula for Crankshafts. S. S. Zimanenko (*Vestnik Inzhenerov i Tekhnikov*, No. 2, February, 1946, pp. 51–58.) *The Engineers' Digest*, Vol. 3, No. 11, November, 1946, pp. 537–540, figs. (An abridged translation.)

An investigation was conducted to obtain a more accurate formula for the calculation of torsional oscillations in the crankshafts of modern high-speed, multiple-cylinder engines. The proposed formula developed was found to be simple, universal, and suitable for both the older type of crankshaft and the modern types for which the best of the older formulas is inadequate.

Analyses of High-Speed Crankshaft Loads. I. J. E. Binding. *Aircraft Engineering*, Vol. 18, No. 213, November, 1946, pp. 372–378, figs. 20 references.

Analytical methods are presented for the evaluation of the loads acting on the crankshaft of an in-line engine and a radial engine. The weights of the connecting rods and reciprocating assemblies are determined from the initial engine design, and the magnitude of the gas forces are deduced from a hypothetic indicator diagram. The magnitude and direction of the forces acting on the crankshaft, which are induced by the gas pressure in the cylinder, the inertia forces of the crank mechanism and reciprocating parts, and the centrifugal forces due to the rotation of the crank throws and balance weights, are determined for a number of angular intervals in the complete engine cycle. Consideration is given to

the derivation of the crankshaft bending moments and journal bearing reactions.

Aircraft Engine Starters. Arthur Beier. *SAE Journal*, Vol. 54, No. 12, December, 1946, pp. 47, 48. (Abstract of an address.)

Details of a research program directed toward alleviating engine-starting troubles experienced by manufacturers and users of aircraft. Through this work the weight of electric-starter installations on military aircraft was reduced by one-half; the reliability of starting equipment was increased; and operation, installation, and maintenance of the equipment were simplified.

Bearing Selection Guided by Relative Material Merits. R. A. Watson and W. E. Thill. *SAE Journal*, Vol. 54, No. 12, December, 1946, pp. 41–46, figs. (Abstract of an address: "Practical Aspects of Sleeve Bearing Materials.")

Nine qualifications definitely desirable in a bearing are defined as fatigue resistance, conformability, embeddability, antiscoring, corrosion resistance, capability of operating with unhardened shafts, bondability, temperature-strength ratio, and thermal conductivity. To illustrate how present bearing materials compare with each other as regards these properties, charts are presented for eight alloy families, including tin-base babbitts, high-lead babbitts, cadmium alloys, copper alloys, copper alloys (overplated). The charts portray the wide range of values each family of alloys has when plotted against desirable properties that make up a good bearing. The charts are then combined to examine each bearing alloy in all its phases.

La Suralimentation des Moteurs d'Aviation (The Supercharging of Aircraft Engines.) Jean Villey. *France, Direction des Industries Aéronautiques, Publications Scientifiques et Techniques, Notes Techniques No. 14*, May, 1944. 52 pp., figs. Gauthier-Villars, Paris. 40 fr. A review of the theory, including comparisons of the various types, and applications to Diesel engines.

Construction of Finned Aluminum Muffs for Aircraft-Engine Cylinder Barrels. Langley Memorial Aeronautical Laboratory. *U.S., N.A.C.A., Confidential Bulletin (Wartime Report No. E-81)*, April, 1942. 11 pp., illus.

A New Jointing Compound. A. T. B. P. Squires. *Aircraft Engineering*, Vol. 18, No. 213, November, 1946, pp. 379–384, illus.

A jointing compound developed in the Rolls-Royce laboratories has overcome difficulties experienced in sealing the joints of Merlin and Griffon engines where gaskets and washers are used and vibration is present. The new compound has proved successful in preventing oil leakage through the joints of these engines and also in miscellaneous accessories. The writer first summarizes the properties required of a jointing compound, which include flowability combined with good adhesion. He cites the experience gained with proprietary materials and the new compound, and describes the properties of the latter and the method of applying it to the joint.

Bullet-Proof Fuel Tanks; The Use of Plastics Material in Flexible Fuel Cells for Aircraft. *British Plastics*, Vol. 18, No. 210, November, 1946, pp. 509, 510, illus. The history of the development of the "Marflex" fuel cell for aircraft, and the method of manufacture.

The Quick Clip Fastener. *Industrial Metal Products Laboratory, Release*, Recd. December 17, 1946. 2 pp.

The Quick Clip Fastener is provided with an adapter to hold ignition wiring or oil and fuel lines in place but can be detached quickly for replacement. The slide clip is under spring tension and is not affected by vibration. Pressure in an upward direction permits the removal of the whole unit. The fastener is made in four sizes—3, 5, 6, and 8 in.

Cuno Filters. *Aviation Service Magazine*, December, 1946, pp. 24, 25, 37, illus.

A Method for Studying Piston Friction. J. E. Forbes and E. S. Taylor. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. W-37)*, March, 1943. 30 pp., illus. 4 references.

Computation of the Mean Tangential Velocity of the Air Leaving the Blade Tips of a Centrifugal Supercharger. W. Byron Brown. *U. S., N.A.C.A., Restricted Bulletin No. E5G21 (Wartime Report No. E-11)*, August, 1945. 8 pp., diagrs. 5 references.

Engines—General

A Thermocouple for Measuring Temperatures in Air-Cooled Aircraft Engine Cylinders. T. S. Keeble. *Australia, Council for Scientific and Industrial Research, Division of Aeronautics, Engines Note No. 99*, February, 1946. 14 pp., illus.

A copper-constantan thermocouple was developed for ready insertion into the walls of aircraft-engine air-cooled cylinders, to measure the temperature at selected points and determine the relative cooling properties. The device was calibrated by the use of a heated metal testing block and an air stream of known temperature, allowing for losses in the leads and other variables. Results obtained by the device were satisfactory for the purposes for which it was intended, but improvements could be made by reducing the size of the couple and of the leads.

Power Installations. I. F. M. Owner. *Flight*, Vol. 50, No. 1980, December 5, 1946, pp. 625–627, illus. (Summary of an address.)

The various types of aircraft likely to be produced during the next 5 to 10 years are outlined, together with the power units that will be required. Sections are devoted to the classification of aircraft requirements, the classification of power plants, possible power installations, installation requirements, the general trend of developments, and conclusions on engineering problems. A chart shows most of the important types of aircraft power plants.

Elementary Formulae of Rocket & Jet Propulsion. M. Z. Krzywoblocki. *American Rocket Society, Journal*, No. 68, December, 1946, pp. 23, 24. 3 references. Simple formulas are presented for determining the kinetic energy and reactional forces of the gases in rocket and jet engines.

Fuel-Air Ratio Required for Constant Pressure Combustion of Hydrocarbon Fuels. Newman A. Hall. *SAE Journal*, Vol. 54, No. 12, December, 1946, pp. 32–36, figs. (Abstract of an address.)

Five charts make possible the simple, quick determination of the ratios. The background of their development and the method of using them are discussed. The charts correct for variations in heat of combustion, fuel hydrogen-carbon ratio, and products of previous combustion and water vapor in the inlet air. Only lean mixtures are considered, since they cover most cases of constant-pressure combustion.

British Powerplant Progress. John W. Morrison. *Aero Digest*, Vol. 53, No. 6, December, 1946, pp. 78, 79, 118, 121, diagr.

Progress in the power ratings of British reciprocating engines is traced, with mention of the Bristol Centaurus, Napier Sabre, and Rolls-Royce Merlin and Griffon. Reference is made also to advances in gas turbines, as exemplified by the Rolls-Royce Welland, Derwent, Trent, Dart, and Clyde types, Armstrong-Siddeley Python and Mamba, de Havilland Goblin and Ghost, Bristol Theseus and Proteus, and the turbines built by Napier, Metropolitan-Vickers, and others. Specific fuel consumption of the jet is expected to be reduced to 0.875 lb. per hp.-hr. or less, but until a lower rate is achieved the propeller-turbine combination is likely to be the most acceptable for long-range civil operations.

A Note on the Damped Vibration Absorber. John E. Brock. *Journal of Applied Mechanics*, Vol. 13, No. 4, December, 1946, p. A-284.

Formulas for optimum damping for three cases of the dynamic vibration absorber with damping are presented, and the method of derivation is indicated. The cases are those of optimum tuning, constant tuning, and viscous damping (Lanchester-type damper).

Aero-Motors at the Paris Show. *The Aeroplane*, Vol. 71, No. 1853, November 29, 1946, pp. 664–667, illus. Includes tabulated specifications of 35 engines.

Engines at the Paris Show. *Flight*, Vol. 50, No. 1978, November 21, 1946, pp. 569–571, illus. Descriptive.

Britain's Power Units. *Flight*, Vol. 50, No. 1978, November 21, 1946, pp. 566d–566h, 567, 568, illus. Descriptions, cutaway drawings, and tabulated specifications of 27 reciprocating and ten gas-turbine engines.

Aircraft Engines. *Skyways*, Vol. 5, No. 12, December, 1946, pp. 122, 124, 126, 128, illus. Descriptions of 20 models.

Pressure Loss in Ducts With Compound Elbows. John R. Weske. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. W-39)*, February, 1943. 42 pp., figs. 2 references.

AMERICAN OVERSEAS A

Preserves the "Watch o

That our Watch on the Rhine shall be secure in the hands of U. S. occupation troops reunited with their families, American Overseas Airlines has been flying approximately 100 wives and children a week to Germany as part of a War Department program known informally as "Operation Reunion."

Sinclair congratulates American on this important operation. As supplier of famous Sinclair Aircraft Oil over a period of years for American's domestic flights, Sinclair felicitates American Overseas as the first commercial airline to be used in the mass transfer of service families.

Huge Douglas DC-4 Flagships make seven flights a week as "Operation Reunion." Truly, American Overseas Airlines is doing its bit to make post-war occupation of Germany as pleasant as circumstances will permit for American fighting men still away from home.

At left, group of service wives and children board American Overseas Airlines plane at New York's LaGuardia Field for flight to Germany.

AIRLINES
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Service Men's wives, delivered by air, stroll among ruins in a bombed Germany city.

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A Uniform Method for Determining Angular Accelerations in Mechanisms. L. R. Koenig. **Discussion.** *Journal of Applied Mechanics*, Vol. 13, No. 4, December, 1946, pp. A-309–A-313, figs.

Tests of Exhaust Propulsion Nozzles. Paul J. Campbell. *U.S., N.A.C.A., Advance Restricted Report No. 3E21 (Wartime Report No. W-43)*, May, 1943. 24 pp., figs. 1 reference.

Engines, Gas Turbine

A Survey of the Calculated Performance of Jet Power Plants. Joseph H. Keenan and Joseph Kaye. *Paper presented at I.A.S. 15th Annual Meeting*, New York, January 28–30, 1947. (For abstract see "I.A.S. Briefs" on page 26 of this issue, February, 1947.)

Transport Problems With Turbine Power Plants. Frank W. Kolk. *Paper presented at I.A.S. 15th Annual Meeting*, New York, January 28–30, 1947. (For abstract see "I.A.S. Briefs" on page 26 of this issue, February, 1947.)

A Method for Simplifying the Calculations of the Natural Frequencies for a System Consisting of n Rigid Rotating Discs Mounted on an Elastic Shaft. John L. Bogdanoff. *Journal of the Aeronautical Sciences*, Vol. 14, No. 1, January, 1947, pp. 5–18, figs. 8 references.

In the past, the principal source of vibration excitation in a system consisting of n rigid rotating discs mounted on an elastic shaft was unbalance in the discs. With the advent of the aircraft propeller-gas turbine combination, additional exciting forces, generated by the propeller, act on the turbine rotating system. In order to design a system of this type which is free from resonance vibration, it is necessary to know all the positive and negative natural frequencies (N.F.'s) of the system as a function of a disc velocity. A method for finding *all* the N.F.'s for a system consisting of n rigid rotating discs mounted on an elastic shaft is presented. With the assumption of elastic symmetry, the problem is reduced to finding all the roots of a polynomial of $2n$ degree whose coefficients are functions of the angular velocities of the discs. It is also possible to construct an electronic network and a stationary mechanical model which give all and some, respectively, of the N.F.'s of the original (symmetric) system. If the system does not possess elastic symmetry, the method reduces the problem to that of finding all the roots of a similar polynomial of $4n$ degree. For this case (unsymmetric) it is not possible to construct a stationary mechanical model. However, the electronic network can still be made, although it is more complicated than for the symmetric case.

Current Problems in Developing Major Components for Aviation Gas Turbines. Arnold H. Redding. *Aeronautical Engineering Review*, Vol. 5, No. 12, December, 1946, pp. 30–35, 91, illus.

It has been found that problems in the design of the aircraft-propulsion turbine can best be solved generally by working on the individual major components rather than specifically on the engine as a whole. Such an approach, differing from the procedure usually followed in designing a reciprocating engine, enables the designer of a specific turbine engine to meet more nearly the requirements imposed by the type of installation for which the engine is intended. In this paper the functions and requirements of the various major components are presented, together with an evaluation of their present state of development and a listing of the most important current development problems that must be solved in each case.

Analytical Design of Centrifugal Air Compressors. C. Concordia and M. F. Dowell. *Journal of Applied Mechanics*, Vol. 13, No. 4, December, 1946, pp. A-271–A-275, figs.

A general method of design and analysis which has been developed for, and applied primarily to, the design of supercharger centrifugal impellers. The method has also been used as a systematic means for the analysis of such impellers, as well as for the design of the corresponding diffusers and of gas-turbine compressors and turbines. The development was undertaken with the idea of obtaining, as nearly as possible, a self-sufficient and self-contained rational design method that would be influenced as little as possible by preconceived notions of what the impeller blades should look like. The method is also complete in the sense that it is not used merely as a guide to the character of the blade shape, e.g., to determine limiting curvatures. Instead, basic laws of fluid motion are used to determine the required flow path and thus the complete blade shape. Full use is made of available experience and test results as checks of the theory.

Power Units for Future Aircraft. F. R. Banks. *The Intava World*, Vol. 6, No. 4, September, 1946, pp. 79–88, illus.

Predictions that the piston engine will be supplanted, within three periods of 5 years each, for practically all types of aircraft propulsion by one or more forms of gas-turbine power plant, are followed by a detailed review of the development of the gas turbine, especially British types. During the forthcoming 15 years, while the gas turbine is being refined to give better fuel economy and other improvements, the piston engine will continue to render important service, particularly with such improvements as "compounding" to utilize more of the energy of the exhaust gases, such as (a) an exhaust-driven turbine geared to the engine crankshaft; (b) an exhaust turbosupercharger; or (c) by exhausting pairs of working cylinders alternately into a low-pressure cylinder connected to the main crankshaft. British types of gas turbines are described at length, with graphs showing their power output, fuel consumption, and other characteristics. The relative merits of the centrifugal and axial designs are discussed, as well as modifications, such as the ducted fan or augmenter. Fuels for piston engines and for gas turbines are discussed in detail.

Optimum Blade Pitch for Turbo-Machines With Special Reference to Blades of Great Curvature. I. O. Zweipel. (*Brown Boveri Mitteilungen*, Vol. 32, No. 12, December, 1945, pp. 436-444. *The Engineers' Digest*, Vol. 3, No. 11, November, 1946, pp. 568–570, figs. (An abridged translation.)

A coefficient of aerodynamic loading that proved to be a useful criterion in the calculation of pitch for cascades of blades is explained, with an exposition of the mathematical processes followed.

Inspection Procedures for Turbojets. Irving Stone. *Aviation*, Vol. 45, No. 12, December, 1946, pp. 51–54, diagrs.

A step-by-step tabulation of procedures on components of the turbine, compressor, and accessory-drive assemblies. A chart of turbojet troubles and remedies gives the more common causes of turbojet operating difficulties, together with their probable causes, and inspection and maintenance procedure.

How to Tailor Gas Turbine Elements to the Job. N. C. Price. *SAE Journal*, Vol. 54, No. 12, December, 1946, pp. 52, 53, figs. (Abstract of an address: "Mechanical Design Considerations Influencing Blading Performance in Aircraft Gas Turbine Powerplants.") Illustrations show good design requirements for blade structure, compressor casings, rotor drum structures, bearings, and blade attachments.

Bearings for Jet Engines. *Aero Digest*, Vol. 53, No. 6, December, 1946, p. 102, illus.

Certain bearings in the jet power plant of the P-80 Shooting Star must operate at speeds up to 72,000 r.p.m. In addition to high speeds, the bearings are subjected to high temperatures and heavy radial and thrust loads, so that extremely small tolerances are required.

Jet Information Please! *Aircraft and Airport*, Vol. 8, No. 10, November, 1946, pp. 38, 40, 42, illus. A popular explanation of gas turbine principles.

Westinghouse 19B "Yankee." *Interavia* (Geneva), Vol. 1, No. 7, October, 1946, pp. 51–57, illus. (Cf. AER 3/46:89.)

Heat-Capacity Lag in Turbine-Working Fluids. Arthur Kantrowitz and Paul W. Huber. *U.S., N.A.C.A., Restricted Bulletin No. L4E29 (Wartime Report No. L-21)*, May, 1944. 17 pp., figs. 4 references.

The Gas-Turbine Collaboration Committee; Its Development and Progress: 21st Meeting Held. *Aircraft Production*, Vol. 8, No. 98, December, 1946, p. 583, illus.

A General Method for Calculating Critical Speeds of Flexible Rotors. M. A. Prohl. **Discussion.** *Journal of Applied Mechanics*, Vol. 13, No. 4, December, 1946, pp. A-297–A-300, figs.

Jet Planes and Gapa in the Army Air Forces. Estelle R. Schoenholtz. *American Rocket Society, Journal*, No. 68, December, 1946, pp. 29–31, illus.

Notes on the Bristol Theseus Heat-Exchanger Propeller Turbine. *Aircraft Engineering*, Vol. 18, No. 213, November, 1946, pp. 366–371, illus. (Cf. AER 11/46:39.)

Engines, Reciprocating

Relative Cooling Characteristics of "Al-Fin" and Conventional Cylinders for the Australian Built R2000 Engine. T. S. Keebe,

and M. S. Walker. *Australia, Council for Scientific and Industrial Research, Division of Aeronautics, Report No. E.53*, March, 1946. 39 pp., illus. 4 references.

Six cylinders that had been made up for the Australian R2000 engine were tested on a single-cylinder unit, to determine whether the Al-Fin process, applied to two of the six cylinders, would improve their cooling characteristics. The temperatures of the cylinder barrels with aluminum finning were significantly lower than those of the conventional steel-finned cylinders under similar running conditions. The difference is masked somewhat by the arbitrary form of baffling fitted to the cylinders but is of the order of 20 °C. in mean temperature; the decrease in maximum temperature is not so marked, being closer to 10 °C. There is no significant change in cylinder-head mean temperature with alteration of the barrel finning, but the use of the Al-Fin process should result in lower barrel temperatures and better conditions for lubrication of the piston in a given installation.

Forced Torsional Vibrations With Damping: An Extension of Holzer's Method. J. P. Den Hartog and J. P. Li. *Journal of Applied Mechanics*, Vol. 13, No. 4, December, 1946, pp. A-276–A-280, figs.

In the calculation of the free and forced vibrations of torsional systems with small damping, the method of Holzer is widely used. It consists of determining the shapes and frequencies of the free vibrations, disregarding damping. An extension of Holzer's method is given for the case of damped systems of discreet as well as of uniformly distributed inertias and flexibilities.

Power for the Brabazon I. *Flight*, Vol. 50, No. 1979, November 28, 1946, p. 585, illus.

The use of eight Bristol Centaurus engines, coupled in pairs to drive four coaxial airscrews, has been adopted for the Brabazon I as an interim measure. Subsequent aircraft are to be powered by Bristol Proteus airscrew-turbines as standard power plants.

Time Saving Engine Test Procedures. Jim Horak. *Aviation Maintenance & Operations*, Vol. 7, No. 1, December, 1946, pp. 31, 87, 88, illus.

A contribution to the engine-testing technique of a large independent overhaul base is the employment of controllable-pitch engine-test clubs. With such an installation the test engineer can change the pitch of the test-club blades to any position within the power range by closing a switch, eliminating the necessity for shutting down the engine and changing the club to one having a different blade setting. Another feature is the cooling effect provided by the club blades, making it unnecessary to install auxiliary blowers. The new technique is reported to save a minimum of 3 hours for each engine tested.

British Manufacture 'Flat Six' Engine. *Aviation News*, Vol. 6, No. 24, December 9, 1946, p. 14, illus. (Cf. AER 1/47:47.)

Aircraft Engines; Current and Production Models for Commercial and Personal Use. *Aviation Maintenance & Operations*, Vol. 6, No. 6, November, 1946, pp. 117–135, illus. Specifications of 78 engines of nine American manufacturers.

5,000-Hp. Lycoming Revealed. J. H. Carpenter. *Aviation*, Vol. 45, No. 12, December, 1946, pp. 86, 87, illus. (Cf. AER 12/46:53.)

Lycoming's 36-Cylinder Radial. *Aero Digest*, Vol. 53, No. 6, December, 1946, pp. 82, 83, illus. (Cf. AER 12/46:53.)

Dilution of Exhaust-Gas Samples From a Multicylinder Engine Equipped With an Exhaust-Gas Collector. Helmut F. Butze. *U.S., N.A.C.A., Restricted Bulletin No. E5B10 (Wartime Report No. E-63)*, February, 1945. 9 pp., illus. 1 reference.

An Estimation of the Internal-Cooling Requirements of an Aircraft-Engine Cylinder When Using Oxygen Boost. John C. Evvard and W. E. Moeckel. *U.S., N.A.C.A., Restricted Bulletin No. E4K21 (Wartime Report No. E-91)*, November, 1944. 6 pp., figs. 3 references.

Effect of Changing the Stroke on Air Capacity, Power Output, and Detonation of a Single-Cylinder Engine. James C. Livengood and James V. D. Eppes. *U.S., N.A.C.A., Advance Restricted Report No. 4E24 (Wartime Report No. W-50)*, February, 1945. 26 pp., figs. 5 references.

A Proposed Method of Measuring Engine Charge Air Flow in Flight. T. J. Voglewede. *U.S., N.A.C.A., Confidential Bulletin No. L4E25 (Wartime Report No. L-200)*, May, 1944. 10 pp., figs. 2 references.

Effect of Exhaust Back Pressure on Engine Power. Benjamin Pinkel. *U.S., N.A.C.A., Confidential Bulletin No. 3F17 (Wartime Report No. E-116)*, June, 1943. 23 pp., figs.

Method of Mounting Cylinder Blocks of In-Line Engines on CUE Crankcases. C. D. Waldron and A. E. Biermann. *U.S., N.A.C.A., Restricted Bulletin No. E4G27 (Wartime Report No. E-27)*, July, 1944. 11 pp., illus. 1 reference.

Use of Water Injection to Decrease Gasoline Consumption in an Aircraft Engine Cruising at High Power. Helmuth W. Engelman and H. Jack White. *U.S., N.A.C.A., Restricted Bulletin No. E4H12 (Wartime Report No. E-21)*, August, 1944. 8 pp., figs. 4 references.

Cylinder-Head Cooling by Means of a Shield in the Exhaust Passage. H. D. Wilsted and B. A. Mulcahy. *U.S., N.A.C.A., Restricted Bulletin No. E4F23 (Wartime Report No. E-34)*, June, 1944. 13 pp., diagrs. 7 references.

The Effect of Oil Consumption and Piston Cooling on Knock-Limited Aircraft-Engine Performance. Merle C. Huppert, Harry S. Imming, and Paul H. Richard. *U.S., N.A.C.A., Restricted Bulletin No. E4EO4 (Wartime Report No. E-22)*, May, 1944. 13 pp., figs. 4 references.

Calculations of Intake-Air Cooling Resulting From Water Injection and of Water Recovery From Exhaust Gas. Addison M. Rothrock. *U.S., N.A.C.A., Restricted Bulletin No. E4H26 (Wartime Report No. E-95)*, August, 1944. 22 pp., figs. 4 references.

A Positive-Replica Technique for Examining Finished Metal Surfaces and Its Application to Aircraft-Engine Cylinders. Thomas P. Clark. *U.S., N.A.C.A., Restricted Bulletin No. E4I07 (Wartime Report No. E-107)*, September, 1944. 12 pp., illus. 8 references.

End-Zone Water Injection as a Means of Suppressing Knock in a Spark-Ignition Engine. Rinaldo J. Brun, H. Lowell Olsen, and Cearcy D. Miller. *U.S., N.A.C.A., Restricted Bulletin No. E4I27 (Wartime Report No. E-72)*, September, 1944. 13 pp. 8 references.

Relative Effects of Cylinder-Head and Inlet-Mixture Temperatures upon Knock Limits of Fuels. Newell D. Sanders, Jerrold D. Wear, and Reece V. Hensley. *U.S., N.A.C.A., Restricted Bulletin No. E4J13 (Wartime Report No. E-37)*, October, 1944. 10 pp., figs. 4 references.

Engines, Rocket

Rocket-Assisted Take-Offs. Zbigniew Krzywoblocki. *Aero Digest*, Vol. 53, No. 6, December, 1946, pp. 75–77, 152, 153, tables. 5 references.

A method is presented for computing the size and weight of powder rockets for assisting the take-off of gliders or powered aircraft, as well as for reducing the take-off distance for land and water operations. The computations led to the conclusion that powder rockets are feasible for auxiliary propulsion during the take-off of powered gliders or for the take-off of a towing flight. The rockets may also find application to gliders for take-off from surfaces that are level or inclined. By using powder rockets with landplanes, take-off distances and time can be reduced by 30 to 48 per cent, while the landing run can be shortened by approximately 37 per cent. Rockets effect a greater reduction in take-off distance when the landplane is overloaded, but their use is doubtful when an obstacle is to be cleared, because of the weight of the propellant. Rocket application is even more effective with seaplanes, where take-off time and distance are reduced by 40 to 50 per cent with comparatively small rockets. Similar computation methods can be used for propellants other than powder.

NACA Reveals Secret Guided Missile. *U.S., N.A.C.A., Release*, December 23, 1946. 3 pp., illus.

The "Tiamat," a guided research missile, which has been developed in great secrecy over a period of 2 years by the N.A.C.A. is not a war weapon but has been developed and tested as a model for future missiles containing explosive warheads and target-seeking equipment. It is described as the first guided missile to be flown successfully through a predetermined program of maneuvers. The missile is 14 ft. 4 in. long and weighs about 600 lbs. It has a flying speed of approximately 600 m.p.h., although its design can be adapted to supersonic missiles powered by various types of jet engines. It is launched from a zero-length rocket launcher by the power of a "rocket booster" assembly mounted on its tail. This assembly produces 7,200 lbs. of thrust for $3^1/_2$ sec., which is sufficient time to get the missile up to its normal flying speed. After exhaustion of the rocket booster, the entire

New B. F. Goodrich assembly gives maintenance men a break

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assembly drops away in flight and an internal rocket engine, which develops 200 lbs. of thrust continuously for 45 sec., continues the flight. Because the Tiamat is a research missile, not a war weapon, it carries a large number of instruments on its flight to provide a record of such basic information as speed, control movements, degrees and speed of roll, and data on its vertical and lateral acceleration.

U.S. Rocket Engine Flight Test Points Way to New Developments. *Aviation News*, Vol. 6, No. 26, December 23, 1946, pp. 8, 9, illus. (Cf. AER 1/47:38.)

Comments on the prospects for the rocket engine and particulars about the Bell-built XS-1 and its four-barreled rocket engine, designated as 6000C4, which was developed by Reaction Motors, Inc., under contract with the Navy Bureau of Aeronautics.

The Variable Nozzle as a Means of Maintaining Rocket Engine Efficiency When Throttling. Harry W. Burdett. *American Rocket Society, Journal*, No. 68, December, 1946, pp. 39–41, figs.

Man-Made Satellites; Gravity-Free Rockets Are No Longer Impossible. E. M. Rogers. *Army Ordnance*, Vol. 31, No. 159, November-December, 1946, pp. 247, 248.

Some Possibilities for Rocket Propellants. I. Arthur S. Leonard. *American Rocket Society, Journal*, No. 68, December, 1946, pp. 12–18.

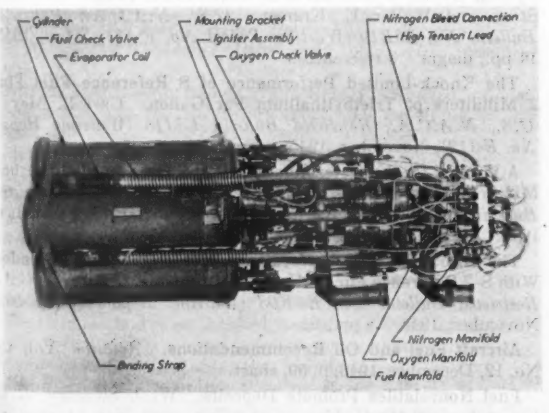
An investigation of the relative suitability of various chemical substances for use as rocket propellants. The primary objective is to select the propellants that will give the rocket the highest possible final velocity. New equations are derived by which the various elements and compounds may be rated. This method of rating has opened, for experimental investigation, a whole new class of materials which, by the previous criteria, appeared to hold little promise of being useful as propellants. Included in this group are elements and compounds of high density.

Hydrogen Peroxide for Propulsive Power. Logan McKee. *Mechanical Engineering*, Vol. 68, No. 12, December, 1946, pp. 1045–1048, fig.

The production and use of hydrogen peroxide for power purposes is discussed, with particular attention to activities in Germany during the war and the application of the fuel to the propulsion of V-bombs, airplanes, and submarines.

Liquid Propellant Rocket Development. M. W. Nesbitt. *American Rocket Society, Journal*, No. 68, December, 1946, pp. 1–11, illus.

Broad aspects of development in liquid-propellant rockets are discussed. After defining some of the terms widely used in this field of engineering, consideration is given to means of injecting the propellant and the advantages of the pressurized method. Liquid propellants and the characteristics of each are described. Following an examination of the various problems involved in scaling up the size of a liquid-propellant rocket engine to the power range now being planned, attention is given to the physical characteristics of modern rocket engines, the method of measuring their thrust, and their applications for aircraft propulsion.



Side view of Reaction Motors, Inc., 1500 N4C Rocket Engine. (See "Liquid Propellant Rocket Development.")

Fire Prevention

Fire Fighting Equipment. *Airports & Air Transportation* (London), Vol. 1(N.S.), No. 42, November, 1946, p. 279. A brief description of fire-warning and extinguishing equipment produced by the Graviner Manufacturing Co. Ltd., of England.

Complete Fire Protection Installed on American DC-4's. I. J. Hamill. *Kidde Industry*, Vol. 3, No. 5, September, 1946, pp. 2, 3, illus.

A Meter for the Measurement of the Properties and Quantity of Foam. N. O. Clark. *Journal of Scientific Instruments*, Vol. 23, No. 11, November, 1946, pp. 256–259, figs. 7 references. A helicoid flowmeter that can be used for investigating the fire-fighting behavior of foams.

Fire-Fighting Trials on Magnesium-Base Alloys. *Engineering*, Vol. 162, No. 4219, November 22, 1946, pp. 481–483, illus.

Flight Technique

Open Sea Seaplane Operations. *Air-Sea Safety* (Washington), Vol. 1, No. 1, November, 1946, pp. 45–51, illus.

Tests conducted by the Coast Guard in the Pacific Ocean developed techniques for alighting on rough seas. Extensive study of wave formation revealed the causes of numerous accidents and damage to water-based aircraft during open-sea landings and take-offs, and led to procedures that made such operations satisfactory. Results obtained by jet-assisted take-off equipment are described.

Check That Check List. Ward Taylor. *Southern Flight*, Vol. 26, No. 6, December, 1946, pp. 20, 21, illus.

Emphasis is placed on the importance of using a check list showing the sequence of operations to be performed before starting, take-off, and landing, and the extent to which such a list will contribute to safe flying. Some typical factory-approved check lists for personal planes are shown.

Learn to Fly. V.—S-Turns. John R. Hoyt. *Air Trails*, Vol. 27, No. 4, January, 1947, pp. 46, 47, 78–81, diagrs.

Let's Learn to Fly. VIII—Nose Position Is Not the True Indicator of a Stalled Condition—Recognizing and Controlling the Stall Is Essential to Landings. Arnold Warren. *Canadian Aviation*, Vol. 19, No. 12, December, 1946, pp. 76, 78, 80, 84, figs.

Refills in Flight. Oscar Leiding. (Wing Talk, Edited by F. R. Neely.) *Collier's*, Vol. 118, No. 24, December 14, 1946, p. 133. The beginnings of refueling in flight and the method used by Flight Refueling, Ltd., to increase the range of transport aircraft.

Flight Testing and Performance

Progress in Dynamic Stability and Control Research. William F. Milliken, Jr. *Paper presented at I.A.S. 15th Annual Meeting*, New York, January 28–30, 1947. (For abstract see "I.A.S. Briefs" on page 26 of this issue, February, 1947.)

The Longitudinal Stability of an Aircraft With Free Elevator. W. S. Brown. *Gt. Brit., Aeronautical Research Committee, Reports and Memoranda No. 1981*, April 1, 1943. 24 pp., figs. 8 references. British Information Services, New York. $1.35.

Attention is confined in the main to the rapid oscillation that is the control-column-free counterpart of the rapid control-column-fixed mode. The latter is always heavily damped but it is shown that, when the control column is free, it is possible under certain conditions of elevator aerodynamic and mass balance for the damping to become negative. The infrequency of trouble of this kind, when it might have been expected, may be attributable to the effects of friction in the elevator circuit.

Directional Stability of Beaufort Mk.IX in Take-Off and Landing. L. D. Chippindall and R. J. Yates. *Australia, Royal Australian Air Force, Aircraft Performance Unit No. 1, Laverton, Performance Report, Detail No. 682/9/98*, November, 1945. 8 pp., illus.

Following a number of reports of lack of controllability on take-off and landing, tests were carried out with various loadings (c.g. positions varying from forward to aft). Under no condition was it found that the Beaufort Mk.IX was any less stable than the ordinary Beaufort, in either take-off or landing.

Flight Test Report. VIII—The Westland Whirlwind. *Air Review* (London), Vol. 8, No. 1, November, 1946, pp. 34–37, illus.

First XS-I Powered Flight Opens Drive to Supersonic Speeds. *Aviation News*, Vol. 6, No. 25, December 16, 1946, p. 9, illus. (Cf. AER 1/47:38.)

Effect of Power on the Stick-Fixed Neutral Points of Several Single-Engine Monoplanes as Determined in Flight. Maurice D. White. *U.S., N.A.C.A., Confidential Bulletin No. L4H01 (Wartime Report No. L-24)*, August, 1944. 8 pp., figs.

Effect of Ground on Characteristics of Model of a Low-Wing Airplane with Full-Span Slotted Flap With and Without Power. I. G. Recant and A. R. Wallace. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. L-335)*, September, 1942. 30 pp., figs. 6 references.

Requirements for Satisfactory Flying Qualities of Airplanes. R. R. Gilruth. *U.S., N.A.C.A., Advance Confidential Report (Wartime Report No. L-276)*, April, 1941. 27 pp. 12 references.

Analysis of Vertical-Tail Loads in Rolling Pull-Out Maneuvers. Robert R. Gilruth. *U.S., N.A.C.A., Confidential Bulletin No. L4H14 (Wartime Report No. L-181)*, August, 1944. 6 pp., figs.

Estimation of Stick-Fixed Neutral Points of Airplanes. Maurice D. White. *U.S., N.A.C.A., Confidential Bulletin No. L5C01 (Wartime Report No. L-116)*, March, 1945. 21 pp., diagrs. 7 references.

Flight Tests of Two Airplanes Having Moderately High Effective Dihedral and Different Directional Stability and Control Characteristics. S. A. Sjoberg. *U.S., N.A.C.A., Confidential Bulletin No. L5H08 (Wartime Report No. L-40)*, October, 1945. 15 pp., illus. 1 reference.

Analysis of Effect of Rolling Pull-Outs on Wing and Aileron Loads of a Fighter Airplane. Henry A. Pearson and William S. Aiken, Jr. *U.S., N.A.C.A., Advance Restricted Report L5I04 (Wartime Report No. L-270)*, March, 1946. 81 pp., figs. 6 references.

Determination From Flight Tests of Thrust Coefficients for 10 Full-Scale Airplanes in the Gliding Condition With Engine Idling. Donald B. Talmage. *U.S., N.A.C.A., Restricted Bulletin No. L5F08 (Wartime Report No. L-88)*, June, 1945. 13 pp., figs. 2 references.

A Comparison of Data Obtained by Two Flight Techniques for Determining the Sideslip Characteristics of a Fighter Airplane. Harold I. Johnson. *U.S., N.A.C.A., Restricted Bulletin No. L5F25a (Wartime Report No. L-87)*, August, 1945. 10 pp. 3 references.

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Effect of Lateral Shift of Center of Gravity on Rudder Deflection Required for Trim. W. H. Phillips, H. L. Crane, and P. A. Hunter. *U.S., N.A.C.A., Restricted Bulletin No. L4I06 (Wartime Report No. L-92)*, November, 1944. 9 pp., illus.

Spinning of Large Airplanes. Oscar Seidman. *U.S., N.A.C.A., Restricted Bulletin No. L4I07 (Wartime Report No. L-96)*, October, 1944. 15 pp., fig. 1 reference.

Notes on Unusual V-G Records From Transport Airplanes. Walter G. Walker. *U.S., N.A.C.A., Restricted Bulletin No. L4H17 (Wartime Report No. L-36)*, August, 1944. 21 pp., figs. 2 references.

Theoretical and Experimental Dynamic Loads for a Prismatic Float Having an Angle of Dead Rise of 22½°. Wilbur L. Mayo. *U.S., N.A.C.A., Restricted Bulletin No. L5F15 (Wartime Report No. L-70)*, July, 1945. 15 pp. 8 references.

Variation of Hydrodynamic Impact Loads With Flight-Path Angle for a Prismatic Float at 3° Trim and With a 22½° Angle of Dead Rise. Sidney A. Batterson. *U.S., N.A.C.A., Restricted Bulletin L5A24 (Wartime Report No. L-211)*, February, 1945. 8 pp., illus. 1 reference.

Variation of Hydrodynamic Impact Loads With Flight-Path Angle for a Prismatic Float at 6° and 9° Trim and a 22½° Angle of Dead Rise. Sidney A. Batterson and Thelma Stewart. *U.S., N.A.C.A., Restricted Bulletin No. L5K21 (Wartime Report No. L-69)*, February, 1946. 10 pp., figs. 4 references.

Variation of Hydrodynamic Impact Loads With Flight-Path Angle for a Prismatic Float at 12° Trim and With a 22½° Angle of Dead Rise. Sidney A. Batterson. *U.S., N.A.C.A., Restricted Bulletin No. L5K21a (Wartime Report No. L-68)*, February, 1946. 9 pp., figs. 3 references.

Fuels

Performance-Rating of Fuels. T. B. Rendel. *Aero Digest*, Vol. 53, No. 6, December, 1946, pp. 105, 155, figs.

The mixture-response curve, or graphic representation of the variation in knock-limited power output with the fuel-air ratio, has taken the place of octane rating to a great extent as a measure of the rich-mixture performance specification for aircraft fuels. Information for the construction of such curves is obtained by setting the boost pressure at a certain value and then, starting with a rich mixture, decreasing the ratio of fuel to air until the engine knocks perceptibly. The application of the method and research work in connection with the manufacture of aircraft fuels are described, including the development of the synthetic hydrocarbon cumene as a blending agent. The conventional octane rating can be used to designate lean-mixture or cruising performance for current fuels, and for rich-mixture conditions the performance is expressed as a per cent of the power of the reference fuel used in research.

Knock-Limited Performance of Blends of AN-F-28 Fuel Containing 4 Percent Aliphatic Amines. Leonard K. Tower. *U.S., N.A.C.A., Restricted Bulletin No. E5D17 (Wartime Report No. E-90)*, April, 1945. 6 pp., figs. 1 reference.

Fuel-Vaporization Loss as Determined by the Change in the Specific Gravity of the Fuel in an Aircraft Fuel Tank. Charles S. Stone and Walter E. Kramer. *U.S., N.A.C.A., Restricted Bulletin No. E5E19 (Wartime Report No. E-113)*, May, 1945. 14 pp., diagrs. 3 references.

The Knock-Limited Performance of S Reference Fuel Plus 2 Milliliters of Triethylthallium Per Gallon. Carl L. Meyer. *U.S., N.A.C.A., Restricted Bulletin E5J15 (Wartime Report No. E-112)*, November, 1945. 5 pp., fig. 1 reference.

A Method for the Determination of Aromatics in Hydrocarbon Mixtures. Harold F. Hipsher. *U.S., N.A.C.A., Restricted Bulletin No. E5K06 (Wartime Report No. E-111)*, December, 1945. 12 pp., figs. 3 references.

The Knock-Limited Performance of Several Fuels Blended With S-2 Reference Fuel. Henry E. Alquist. *U.S., N.A.C.A., Restricted Bulletin No. E4K03 (Wartime Report No. E-92)*, November, 1944. 8 pp., figs.

Aircraft Fuel and Oil Recommendations. *Aviation*, Vol. 45, No. 12, December, 1946, p. 59, chart.

Fuel Nonvolatiles Promote Deposits. W. J. Sweeney, J. F. Kunc, Jr., and W. E. Morris. *SAE Journal*, Vol. 54, No. 12, December, 1946, p. 65, illus. (Abstract of an address.)

Gliding and Soaring

Military Prototypes. XXIV—The General Aircraft G.A.L. 55. *The Aeroplane Spotter*, Vol. 7, No. 176, November 30, 1946, p. 285, illus.

This glider was designed during the war for elementary and advanced training. It is a two-seat monoplane with tricycle landing gear, dive brakes, and atmospherically controlled bellows-type flaps. It is of wood and steel construction.

Short Nimbus Sailplane. *Flight*, Vol. 50, No. 1979, November 28, 1946, p. 585, illus. Descriptive. The Short Bros. Nimbus two-seater, low-gull-wing sailplane is equipped with dual controls, elevator trim tabs, and diving brakes.

Military Prototypes. XXV—The General Aircraft G.A.L. 56. *The Aeroplane Spotter*, Vol. 7, No. 176, November 30, 1946, p. 285, illus. (Cf. AER 12/46:55.)

Gliders to the North. Robert J. Willingham, 3d. *Air-Sea Safety* (Washington), Vol. 1, No. 1, November, 1946, pp. 21–23, illus. The services performed by CG-4A and CG-15 gliders in connection with the "Operation Musk-Ox" expedition in northern Canada early in 1946 are reviewed.

Gliding Records. *Flight*, Vol. 50, No. 1980, December 5, 1946, p. 617.

Government Agencies

Reorganisation of Civil Aviation Administration, New Zealand. *New Zealand, Air Department, Information Circular*, Vol. 3, No. 32, October, 1946, pp. 6, 7.

Guided Missiles

Flight Testing of Guided Missiles. Harold K. Cheney. *Paper presented at I.A.S. 15th Annual Meeting*, New York, January 28–30, 1947. (For abstract see "I.A.S. Briefs" on page 26 of this issue, February, 1947.)

Ice Prevention

De-Icing of an Aircraft-Engine Induction System. Henry A. Essex. *U.S., N.A.C.A., Advance Restricted Report No. 3H13 (Wartime Report No. W-45)*, August, 1943. 67 pp., figs. 1 reference.

Instruments—General

Timing Instruments for Record-Breaking Jet Planes. Robert King. *Instruments*, Vol. 19, No. 12, December, 1946, pp. 729, 730, illus.

A brief description of the photographic equipment and instrumentation used in timing aircraft speed runs from the ground. The article is especially concerned with two contributing factors in the accuracy of aircraft speed measurements: (1) the accuracy of course length and alignment, and (2) the precision and accuracy of the timing devices themselves.

Timing the AAF Speed Trials. Robert King. *Western Flying*, Vol. 26, No. 12, December, 1946, p. 46, illus. (Cf. preceding abstract.)

Sticking Instruments Show Careful Repair Is Needed. *Canadian Aviation*, Vol. 19, No. 12, December, 1946, pp. 91, 94, 96, 98, diagrs.

Instrument Range Limits. *Douglas Service*, Vol. 4, No. 12, December, 1946, pp. 7–9, figs.

The Calibration of Venturi Meters. A. Vibert. (*Le Génie Civil*, Vol. 123, No. 11, June 1, 1946, pp. 138–141.) *The Engineers' Digest*, Vol. 3, No. 11, November, 1946, pp. 574–576. (An abridged translation.)

Despite the universal application of venturi counters, the accuracy of their readings is still questioned by some engineers. A theoretic method is established to calibrate these instruments *a priori* by an approximation at least equal to that obtainable by the more or less empiric means that have been used.

The Friction of Recording Pens on Paper. W. E. Knowles Middleton. *American Meteorological Society, Bulletin*, Vol. 27, No. 9, November, 1946, pp. 483–487, figs. 1 reference.

Instruments, Engine

The Electrical Measurement of Pressures and Indicator Diagrams. E. J. B. Willey. *Journal of Scientific Instruments*, Vol. 23, No. 11, November, 1946, pp. 264–269, figs. 30 references.

Following a brief discussion of the various electrical methods, apparatus of a simple kind is described, with working details, for (a) two pressure condensers, (b) a capacity-coupled amplifier usable down to 5 cycles per sec., (c) a direct-coupled cathode-follower circuit, and (d) special nonlinear time bases to convert pressure-time curves into indicator diagrams.

A Preignition Indicator for Aircraft Engines. Thomas Dallas, Gene Hoss, and Myron L. Harries. *U.S., N.A.C.A., Restricted Bulletin No. E5A31 (Wartime Report No. E-40)*, February, 1945. 13 pp., illus.

An Electronic Indicator for Angular Velocity and Acceleration. Richard P. Krebs. *U.S., N.A.C.A., Restricted Bulletin No. E4H21 (Wartime Report No. E-56)*, August, 1944. 14 pp., diagrs. 4 references.

Instruments, Flight

The Miles "Co-Pilot." *Flight*, Vol. 50, No. 1979, November 28, 1946, p. 584, illus.

A lightweight automatic control system for smaller aircraft has been developed by Miles Aircraft. It is entirely electric, with separate control servomotors driven from power supplied by the amplified signals recording the movements of a gyroscope. The gyro displacements are recorded by a photoelectric pick-off.

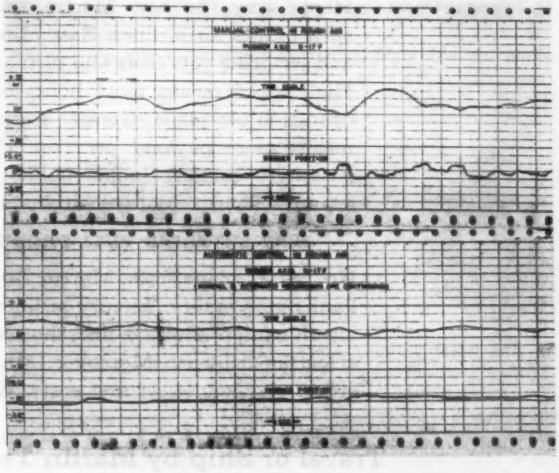
Automatic Control for Aircraft. John C. Newton. *Instruments*, Vol. 19, No. 12, December, 1946, pp. 722–725, figs.

Having defined automatic control as the constraint of an aircraft to a predetermined attitude and air speed, and having outlined practical aircraft performance requirements, the writer discusses the characteristics of a control system designed to meet the conditions. Details are given about the Sperry Type A-12 Gyropilot, which embodies the principles discussed.

First Step to Automatic Flight; Sperry Demonstrates A-12 Gyropilot. *Aircraft and Airport*, Vol. 8, No. 9, October, 1946, pp. 26, 30, illus.

Effect of Mach Number on Position Error as Applied to a Pitot-Static Tube Located 0.55 Chord Ahead of an Airplane Wing. W. F. Lindsey. *U.S., N.A.C.A., Confidential Bulletin No. L4E29 (Wartime Report No. L-75)*, May, 1944. 10 pp., illus. 7 references.

Static-Pressure Error of an Airspeed Installation on an Airplane in High-Speed Dives and Pull-Outs. John A. Zalovcik and Clotaire Wood. *U.S., N.A.C.A., Restricted Bulletin No. L5K29a (Wartime Report No. L-43)*, February, 1946. 11 pp., illus. 3 references.



Comparison of manual and automatic control. Upper portion is a record of manual flight by a competent pilot through turbulent air. Lower section shows flight performance immediately after Sperry Gyropilot had been engaged. (See "Automatic Control for Aircraft.")

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Nacional (Chile) · Mutual · Flying Tiger · Air Borne Cargo · U. S. · Willis

Liberator (B24M) Position Error. R. Noble. *Australia, Royal Australian Air Force, Aircraft Performance Unit No. 1, Laverton, Performance Report, Detail No. 641/72/18,* June, 1946. 7 pp., illus. 1 reference.

The position-error correction of the static side of the air-speed indicator system of the Liberator B-24M was determined by the Tower Aneroid method, with flaps and landing gear retracted and bomb doors closed, for indicated air speeds between 130 and 220 m.p.h. Correction curves for the indicated air-speed readings are given for normal and alternative static sources at a total weight of 54,700 lbs., and for normal static sources for total weights of 40,000 and 64,000 lbs. Corresponding corrections to be applied to the altimeter readings are shown graphically. Ground effect was negligible. The results given are applicable only to aircraft identical with the aircraft tested, having aerials and "scanner housing" equipment as specified in the report.

Basic Instruments and Their Function. I—The Compass. Bernard I. Diamond. *Southern Flight,* Vol. 26, No. 6, December, 1946, pp. 16–18, illus. The principles of operation, construction, adjustment, and use of the magnetic compass.

Instruments, Meteorological

Tests of the Friez Aerovane in the Natural Wind at Blue Hill Observatory. John H. Conover. *American Meteorological Society, Bulletin,* Vol. 27, No. 9, November, 1946, pp. 523–531, illus.

This new combination windmill anemometer and vane was tested under severe natural wind and icing conditions and compared with a standard 3-cup anemometer, a 6-bladed duralumin windmill, a 3-bladed balsa windmill, and a pressure-tube anemometer. The opinion is expressed that with a few suggested minor improvements the instrument should be a highly satisfactory standard anemometer.

Insurance, Safety, and Rescue

Where Does the Insured Air Passenger Stand? John G. Kelly. *Air Transportation,* Vol. 9, No. 5, November, 1946, pp. 12–14, 16, 18.

The most frequent type of aviation-insurance question presented to the courts is the determination of the effect of the four familiar types of aviation exclusion which in the past were generally included in accidental-death benefit provisions. They may be described as (1) the "participation in aeronautics" or "in aviation operations" exclusion; (2) the "participation in aeronautics" or "in aviation operations as a passenger or otherwise" exclusion; (3) the "engaging in aeronautics" or "in aviation operations" exclusion; and (4) the "engaging in aeronautics" or "in aviation operations as a passenger or otherwise" exclusion. Legal aspects of these questions are discussed, and cases are cited.

For Whom the Bell Tolls. I. *New Zealand, Air Department, Information Circular,* Vol. 3, No. 32, October, 1946, pp. 1–5.

Methods for preventing accidents while in flight are outlined, together with suggestions for action to be taken in the event of fire, turbulence, and collision. The crew should be trained to perform properly in emergencies.

Seaplane Safety. Harold G. Crowley. *U.S., Civil Aeronautics Board, Safety Bulletin No. 172-46,* November 1, 1946. 5 pp.

Causes of seaplane accidents and mishaps are analyzed with a view toward advising the pilot how to avoid similar difficulties. Of 47 accidents studied, 41 occurred while taking off from or coming to rest on a water surface, indicating that the technique of water operations must be thoroughly mastered.

Low-Slow Flying—the Fatal Mistake. Harold G. Crowley. *U.S., Civil Aeronautics Board, Safety Bulletin No. 173-46,* November 1, 1946. 4 pp. Govt. Printing Office, Washington. $0.05. Warnings against the dangers of flying too low and too slowly are illustrated by brief analyses of accidents that have been caused by such errors.

Small-Field Traffic. Harold G. Crowley. *U.S., Civil Aeronautics Board, Safety Bulletin No. 174-46,* November 15, 1946. 4 pp., figs. Govt. Printing Office, Washington. $0.05. An analysis of the causes of 100 air collisions involving private aircraft gives suggestions for improving the safety of civilian flying.

BOAC Plays It Safe. *Canadian Aviation,* Vol. 19, No. 12, December, 1946, pp. 40, 41, 100, 102, illus. The safety program of British Overseas Airways Corp.

The National Safety Council of Australia Has Plans for the Help of Aircraft in Distress. *Aircraft* (Melbourne), Vol. 5, No. 1, October, 1946, p. 26. Recommendations for the organization of emergency night landing teams in country centers, for increasing the number of landing strips, and for the improvement of emergency signals and rescue work.

RAF Equipment Tested in English Channel. *Air Sea Rescue Bulletin,* Vol. 3, No. 9, October, 1946, pp. 2–5, illus. Improvements in the design and use of air-sea rescue and survival equipment are recommended.

Lessons From the Liaisons; The Grasshoppers' Wartime Operations Record Can Point the Way Toward Safer Lightplane Flying in the Future. Wilfred Owen. *Flying,* Vol. 40, No. 1, January, 1947, pp. 38, 39, 84, 86, illus.

Rescue Signals. *Air Sea Rescue Bulletin,* Vol. 3, No. 9, October, 1946, pp. 6–9, figs. Standard ground-air signals adopted by the Army, Navy, and British military services.

Search and Rescue Glossary. *Air Sea Rescue Bulletin,* Vol. 3, No. 9, October, 1946, pp. 26–28. Fifty-three terms in English, French, and Spanish, standardized by PICAO.

Line Throwing Rocket Gun. *Air Sea Rescue Bulletin,* Vol. 3, No. 9, October, 1946, p. 17, illus.

Air Pick-Up. *Air Sea Rescue Bulletin,* Vol. 3, No. 9, October, 1946, pp. 13–16, illus.

Raft Survival of a P-51 Pilot. *Air Sea Rescue Bulletin,* Vol. 3, No. 9, October, 1946, pp. 10–12.

Mark 2, Model O Solar Still. *Air Sea Rescue Bulletin,* Vol. 3, No. 9, October, 1946, p. 12, illus.

Covered Wagon Raft. *Air Sea Rescue Bulletin,* Vol. 3, No. 9, October, 1946, pp. 25, 26, illus.

Paratroopers Life Vest. *Air Sea Rescue Bulletin,* Vol. 3, No. 9, October, 1946, pp. 20, 21, illus.

Navy Yanks 'Em Fast. *Air-Sea Safety* (Washington), Vol. 1, No. 1, November, 1946, pp. 63, 64, illus.

A Navy survey of air-sea rescue work during the war shows that a high percentage of airmen forced down in the Pacific from carrier operations were rescued with the aid of surface vessels, aircraft, and signalling devices. Dye-markers, flashlights, smoke, flares, mirrors, and other signals contributed most to the rescues, while newer methods such as radar and sonobuoys were effective where used.

Overwater Flying Suit. *Air-Sea Safety* (Washington), Vol. 1, No. 1, November, 1946, p. 39, illus.

Protective clothing developed by the Air Matériel Command is intended to take the place of three garments formerly used: the ordinary light flying suit, the life vest, and the emergency-sustenance vest or kit. Inflatable bladders for the neck and chest keep the wearer afloat at sea, and sustenance provisions are carried in the trouser legs.

Airplane Crash Harness. *Air Sea Rescue Bulletin,* Vol. 3, No. 9, October, 1946, pp. 18, 19, illus. (Cf. AER 1/47:53.) A vest-type harness utilizing the stretching property of undrawn nylon to decelerate the forward motion of the body upon crash impact.

Air-Sea Safety in the North Atlantic. Edward H. Smith. *Air-Sea Safety* (Washington), Vol. 1, No. 1, November, 1946, pp. 52–56, illus.

Performances of the Coast Guard in air and sea rescue are related. Weather observations, the Ice Patrol, and other agencies are credited with important parts in maintaining the record of safety and in rescuing the victims of air and sea accidents.

Landing Gear

Analytic Definition of a Retractable Landing Gear Axis of Rotation. Roy A. Liming. *Journal of the Aeronautical Sciences,* Vol. 14, No. 1, January, 1947, pp. 19–23, figs. 2 references.

An analytic solution is presented for the problem of determining a skewed axis of rotation for a retractable landing gear whose motion involves a single articulation. Two simple linear slope equations, developed to define the axis, provide the foundation required for the study of the kinematics system. The application of this analytic technique reduces the solution of a given problem to a few minutes of mechanical manipulation of a standard calculating machine.

While there are other procedures, both graphical and mathematical, available for obtaining a solution to the problem, the writer believes that the method suggested represents the simplest in principle and in practical application to design, as evidenced by the fact that the discussion in this paper represents an abstract of the design procedure used in the North American Aviation Engineering Department with respect to landing-gear development in the preliminary as well as the production design stage.

Two examples are worked out in complete detail to show the high-speed inspection character of the analytic approach.

Bendix Announces Landing Gear for Light Planes. *Bendix Aviation Corp., Bendix Products Div., Release*, Recd. January 3, 1947. 4 pp., illus.

Shock-absorbing main and nose struts, brakes, and wheels have been developed by Bendix to meet the performance and low-cost needs of the private-flier type of light airplanes. The main landing gear is designed for a 1,500-lb. private airplane. It is of the retractable type with levered suspension. It is claimed that the basic principle of this design may be equally adaptable to low-cost cantilever-type retractable struts. The shock-absorbing element consists of a simplified version of the air-oil shock strut. The nose strut and wheel assembly has provision for steering and retracting, while self-centering can be provided if desired. The design is equally adaptable to nonsteerable nose gears. The brake is contained entirely within the wheel. The mounting on the strut spindle is by means of mating hexagonal members that eliminate the usual mounting flange, bolts, nuts, etc. The stationary member of the brake is held upon the hexagon section of the spindle by means of one end-nut. The heat-absorbing element is a floating rotor that is in friction contact during brake application with a lined nonrotating stator or pressure plate on one side, and with rotating lining segments attached to the wheel on the other side.

A New Three-Purpose Hydraulic Master Cylinder for Light Aircraft Brakes. *The Herman Machine and Tool Co., Release*, Recd. December 27, 1946. 2 pp., illus.

A hydraulic master cylinder that serves as a vertical pressure cylinder, a fluid reservoir, and a brake lock for light aircraft will hold a parked plane without the use of chocks. Brakes can be locked automatically at any pressure desired and released by slight pressure on the brake pedal. The lock is applied by pulling a Boden wire on the instrument panel, operating the locking lever and securing the brakes. The new cylinder is made of lightweight steel assembled by electronic brazing. It can be adapted for use with almost all types of hydraulic brakes.

Aircraft Wheels and Brakes: Dunlop Research and Development Departments and Their Equipment: Tyre Balancing: Tyre and Brake Testing. *Aircraft Production*, Vol. 8, No. 11 (97), November, 1946, pp. 541–550, illus.

Crosswind Landing Gear. *Weight Engineering*, Vol. 4, No. 3, Fall, 1946, pp. 28, 29, 34, illus. (Cf. AER 8/46:79.)

Cord Material Paces Plane Tire Progress. R. D. Evans. *SAE Journal*, Vol. 54, No. 12, December, 1946, pp. 67, 68, table. (Abstract of a paper.)

Maintenance

Maintenance Development. W. W. Warner. *Airports & Air Transportation* (London), Vol. 1(N.S.), No. 42, November, 1946, pp. 268, 269, illus. A commentary on various aspects of British air-line maintenance engineering, with emphasis on the importance of keeping maintenance abreast of aircraft design and development.

Periodic Airplane Inspection Requirements. Harvey A. Senior and B. M. Foose. *Aviation Service Magazine*, December, 1946, pp. 16–21, 41, illus.

Use of Airplane Covers and Ground Preheat. Ground Heating; *Douglas Service*, Vol. 4, No. 12, December, 1946, p. 15.

The Landing Gear Warning "Lights Tell the Story." *Douglas Service*, Vol. 4, No. 12, December, 1946, pp. 12–14, figs.

Rivet Cracks; Acceptance Standards for Cracked Rivet Heads. *Douglas Service*, Vol. 4, No. 12, December, 1946, pp. 6, 7, figs.

Storage of Aircraft. Willis L. Nye. *Western Flying*, Vol. 26, No. 12, December, 1946, pp. 30, 31, illus. Recommendations on the preparation of light aircraft for long-term storage.

Heater Fuel Pumps. *Douglas Service*, Vol. 4, No. 12, December, 1946, pp. 1–3, diagr. Maintenance and overhaul of C-54-DC and DC-4 Eclipse No. 744-10B cabin heater fuel pumps.

Servicing Tips for Airliners. VI—Flight Surfaces and Controls. Allen Merkin. *Aviation Maintenance & Operations*, Vol. 7, No. 1, December, 1946, pp. 28, 29. For the Lockheed Constellation, the Douglas DC-3 and DC-4.

Lubrication Chart DC-6. *Douglas Service*, Vol. 4, No. 12, December, 1946, pp. 10, 11, diagrs.

Maintenance Job Methods. I. James M. Linde. *Air Transport*, Vol. 4, No. 12, December, 1946, pp. 61, 62, diagrs. An outline of the consecutive steps to be followed in checking and adjusting parts of the landing gear and controls of the Douglas DC-4 and the Lockheed L-49 Constellation.

Autopilot Shut-Off Valve. *Douglas Service*, Vol. 4, No. 12, December, 1946, pp. 16, 17, diagrs.

Background to Maintenance. *Flight*, Vol. 50, No. 1980, December 5, 1946, pp. 611, 612, illus.

The aircraft maintenance equipment developed at the experimental factory of British Overseas Airways Corporation include engine-overhaul platforms that can be built to any height and improved instrument-test rigs.

Hawker Experience in Structural Repairs. I. E. C. Whittingham and Gisbert D. S. Garrett. *Aircraft Engineering*, Vol. 18, No. 213, November, 1946, pp. 391–394, illus.

Methods of repairing war-damaged airplanes, as carried out by Hawker Aircraft Ltd., were standardized as far as possible. Prompt repairs were made possible by giving the highest priority to the preparation of maintenance publications. Repairs to the tubular structure and the stressed-skin surfaces are described.

Lubrication Stressed in Service Operations at National Airlines. Herb Packer. *Aviation Service Magazine*, December, 1946, pp. 8–13, 26, illus.

Flying Repair Shop for Troubleshooters. *Aviation Maintenance & Operations*, Vol. 7, No. 1, December, 1946, pp. 19–21, 74, 76, illus.

The Latin-American Division of Pan American Airways has speeded emergency repair by the use of a DC-3 provided with shop equipment, spare parts, and skilled mechanics for "on the spot" repair of grounded planes.

Robinson Meets Schedules the Hard Way. John Foster, Jr. *Aviation*, Vol. 45, No. 12, December, 1946, pp. 46, 47, illus. The organization of maintenance at Robinson Airlines.

Slick Features Factory-Type Maintenance. Ruel McDaniel. *Aviation*, Vol. 45, No. 12, December, 1946, pp. 48–50, illus.

The maintenance methods used by a large contract carrier for a fleet of cargo planes. Nine steps in the inspection routine are listed. Details are given about the tooling of the shops.

TWA Improves Maintenance Through Better Tooling. Lee Spruill. *Aviation*, Vol. 45, No. 12, December, 1946, pp. 38–41, illus. Particulars of the planning and equipment of two large maintenance bases for the servicing of Lockheed Constellations.

WAL's Maintenance Work Rises in Peacetime Operations. Scholer Bangs. *Aviation*, Vol. 45, No. 12, December, 1946, pp. 42–44, illus.

Western Air Lines found that the addition of new planes and more schedules, without added working space, posed many difficulties. How these were counterbalanced by the use of ingenious shop-built devices is explained. Future plans call for further work simplification through "floating stockrooms."

Materials—General

AN Pipe, Tube & Hose Fittings for the Aircraft Industry. *Irvin W. Masters, Inc., Catalog, No. 1*, November 15, 1946. 44 pp., illus. For fuel and hydraulic systems.

Expanded Rubber in Aircraft. John S. Trevor. *Aeronautics*, Vol. 15, No. 5, December, 1946, p. 35.

The types and properties of expanded rubber, that is, rubber materials with a nonintercommunicating cellular structure, are discussed and their aeronautical applications described. Consideration is given to hard expanded ebonite, known as Onazote, and to the soft resilient material available under the name of Rubazote.

Stretch to a Stop; Magic Properties of Undrawn Nylon Have Numerous Applications in the Aviation Field. Donald B. Doolittle. *Air Trails*, Vol. 27, No. 4, January, 1947, pp. 34, 35, 68, illus.

NEW *Rainbows* IN THE SKY

Republic Aviation Corporation's superb airliner brings to transportation a new high speed service through the sub-stratosphere. Particularly important to this high altitude operation is the ability of the Rainbow's Curtiss Electric Propellers to dependably perform all operations, including feathering, under any condition of temperature or atmosphere.

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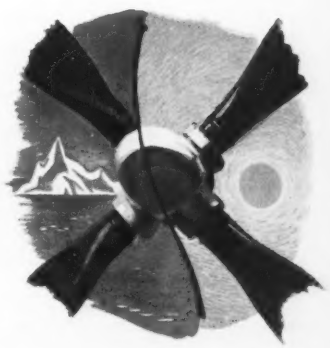

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So, when you buy that personal plane, remember—if it's all-metal, it's safer. If it's Alcoa Aluminum, it's best! ALUMINUM COMPANY OF AMERICA, 2142 Gulf Bldg., Pittsburgh 19, Pa.

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Materials—Metals and Alloys

The Influence of Strain Ageing, Thermal Treatment and Specimen Preparation on the Izod Values of B.S. 3S1 Steel. F. G. Lewis. *Australia, Council for Scientific and Industrial Research, Division of Aeronautics, Report No. SM. 71*, July, 1946. 55 pp., illus. 1 reference.

Izod tests were made over a range of temperatures between -50° and 100°C., together with subsidiary mechanical tests and metallographic examination, on a commercial batch of silicon-aluminum killed B.S. 3S1 steel in the cold drawn and aged, cold drawn and stabilized, and normalized cold drawn and stabilized conditions. Microscopic examination and tensile tests were carried out on the steel in the as-rolled condition. The steel was of satisfactory quality but proved susceptible to strain aging which increased the tensile strength, lowered the Izod value considerably, and shifted the transition range toward higher temperatures. Izod test results were not influenced by surface finish or notch preparation, but square specimens gave slightly higher values than the round. The degree of scattering of Izod values of this steel was due principally to some inherent property of the material although affected slightly by variations in notch depth of the order of 0.01 in.

Sub-Zero Treatment of Steels. G. H. Jackson. *Aircraft Production*, Vol. 8, No. 98, December, 1946, pp. 588–593, figs. 10 references.

It has been suggested by a number of research workers that sub-zero-temperature treatment of steels may prove beneficial. The metallurgical principles that the suggestion involves in the case of the high-speed steels and the high alloy steels are discussed. It is maintained that insufficient practical work has been carried out to substantiate claims of improved life in tool steels, but that the use of low temperatures for alloy steels such as S.82 should be favorably considered since dimensional stability, freedom from stress, and increased hardness values of intricate shapes can be secured.

A Small-Scale Creep-Testing Unit. G. T. Harris. (*Metallurgia*, Vol. 34, No. 201, July, 1946, pp. 129–132.) *The Engineers' Digest*, Vol. 3, No. 11, November, 1946, pp. 555, 556, figs. 3 references. (Abstract.)

A simple and inexpensive test unit was designed for testing samples from fractured gas-turbine discs and blades, and engine valves, where the use of a conventional large-type creep-testing machine proves cumbersome, expensive, and wasteful of test material.

Simplicate and Add More Lightness. John Noble. *Air Review* (London), Vol. 8, No. 1, November, 1946, pp. 44, 45, illus. A review of the activities of Essex Aero Ltd., of England, in the development of lightweight accessories for aircraft, including magnesium-alloy fuel tanks.

Progress Report on Fatigue of Spot-Welded Aluminum. H. W. Russell and L. R. Jackson. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. W-38)*, February, 1943. 47 pp., illus. 1 reference.

Impact Properties at Different Temperatures of Flush-Riveted Joints for Aircraft Manufactured by Various Riveting Methods. G. A. Maney and L. T. Wyly. *U.S., N.A.C.A., Advance Restricted Report No. 5F07 (Wartime Report No. W-53)*, September, 1945. 37 pp., illus. 6 references.

Fatigue Tests of Riveted Joints; Progress Report of Tests of 17S-T and 53S-T Joints. E. C. Hartmann, J. O. Lyst, and H. J. Andrews. *U.S., N.A.C.A., Advance Restricted Report No. 4I15 (Wartime Report No. W-55)*, September, 1944. 32 pp., illus. 20 references.

Column and Plate Compressive Strengths of Aircraft Structural Materials: Extruded 14S-T Aluminum Alloy. George J. Heimerl and Donald E. Niles. *U.S., N.A.C.A., Advance Restricted Report L6C19 (Wartime Report No. L-284)*, May, 1946. 25 pp., figs. 8 references.

Aluminum-Zinc-Magnesium-Copper Casting Alloys. L. W. Eastwood and L. W. Kempf. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. W-31)*, July, 1941. 31 pp., figs. 13 references.

The Effect of Triaxiality on the Technical Cohesive Strength of Steels. George Sachs and J. D. Lubahn. **Discussion.** *Journal of Applied Mechanics*, Vol. 13, No. 4, December, 1946, pp. A-300–A-303, figs. 9 references.

Boost Plane Payload With New Aluminums. J. F. McBrearty. *SAE Journal*, Vol. 54, No. 12, December, 1946, p. 66, fig. (Abstract of an address.)

Extraction and Uses of Beryllium in Germany. George T. Motock. *U.S., Bureau of Mines, Information Circular No. 7357*, June, 1946. 12 pp.

Effect of Particle Size on Iron Powder Properties. I, II. J. F. Kuzmick, J. D. Shaw, and others. *The Iron Age*, Vol. 158, Nos. 23, 24, December 5, 12, 1946; pp. 72–76, tables; pp. 76–80, tables.

Materials—Plastics and Plywood

Three-Ply Flat Panels Under End Compression; Grain of Veneers at 22½° to the Direction of the Load. W. Freiberger and J. P. O. Silberstein. *Australia, Council for Scientific and Industrial Research, Division of Aeronautics, Report No. SM. 66*, March, 1946. 44 pp., illus. 7 references.

The theoretic portion of the paper deals with two problems: (1) panels with all edges simply supported; and (2) panels with loaded edges clamped, sides simply supported. The experimental investigation applies only to the second case. Theory and experiment were found to agree fairly well, although some difficulty was experienced in assessing the correct values of the flexural stiffnesses involved. The postbuckling characteristics of the tested panels were again analyzed and curves of average stress/buckling stress compared with edge stress/buckling stress were derived. A comparison of the strength of these panels with those of orthogonal plywood panels shows that they were only slightly inferior, with regard to buckling stresses and postbuckling behavior, to normal plywood loaded in compression at 0° to the grain of the outer veneers, and were considerably superior to normal plywood loaded at 45°.

The Coefficients of Thermal Expansion of Wood and Wood Products. Richard C. Weatherwax and Alfred J. Stamm. *U.S., Forest Products Laboratory, Madison, Wis., Report No. R1487*, June, 1946. 43 pp., figs. 22 references.

The coefficients of linear thermal expansion of nine species of wood of varying specific gravity were determined in the three structural directions. The species included yellow birch, sugar maple, yellow poplar, cottonwood, balsa, Douglas fir, Sitka spruce, white fir, and redwood. Equations were derived for calculating the expansion coefficients of the woods, the resins and glue contents, the effects of specific gravity, compression, grain direction, and other factors. The agreement between the calculated and observed values was found to be good.

Bolt-Bearing Strength of Wood and Modified Wood: Bearing Strength of Commercial Cross-Banded Compreg Under Aircraft Bolts. P. J. Hunt, H. R. Goodell, and R. S. Phillips. *U.S., Forest Products Laboratory, Madison, Wis., Report No. 1523-B*, February, 1946. 44 pp., illus.

The results of approximately 1,800 bearing tests on single-bolt specimens of commercial cross-banded compreg under steel aircraft bolts. On the basis of these tests, cross-banded compreg can be expected to develop its proportional limit stress in bearing under steel aircraft bolts at deformations not exceeding 0.025 in., and its ultimate at deformations not exceeding 0.10 in.

Resistance of Several Types of Glue in Wood Joints to Fatigue Stressing. W. Z. Olson, D. W. Bensend, and H. D. Bruce. *U.S., Forest Products Laboratory, Madison, Wis., Report No. 1539*, March, 1946. 11 pp., illus.

Glued joints of the kind used in aircraft construction made with eight types of commercial glues, were subjected to repeated stressing on fatigue-testing machines. The glues included alkaline and acid intermediate-temperature-setting phenol resin; alkaline hot-press phenol resin; room-temperature-setting resorcinol resin; intermediate-temperature-setting melamine resin; room-temperature-setting urea resin; and casein. Specimens having thin glue lines withstood average cycles of testing ranging from 31,000 cycles for the casein glue to more than 6,627,500 cycles for the five phenol and resorcinal types. Thick glue lines withstood tests ranging from an average of 20,200 cycles for the casein type to more than 10,000,000 cycles for the two resorcinol types.

Wood-To-Metal Adhesives. Thomas D. Perry. *Mechanical Engineering*, Vol. 68, No. 12, December, 1946, pp. 1035–1040, figs. 17 references.

Following an outline of the products in which plymetal has played an important part, which include aircraft, is a review of

AiResearch Builds "CABIN COMFORT" For Jet Medium Bombers

COCKPIT PRESSURE REGULATOR

COMPRESSED AIR BLED FROM JET ENGINES AT 450° F.

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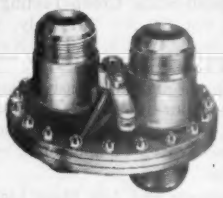
Composed of expansion turbine and heat exchanger. COOLS AIR TO 35° F.



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Regulates cabin temperature by controlling air flow through Refrigeration Unit.

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Air friction around the fuselage of a jet medium bomber boosts cockpit temperatures as much as 40-50° F. This heat must be overcome by introduction of cold air — but all air for the pressurized cockpit comes from the jet compressors at 450° F. Result — a tough cooling problem.

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AiResearch "Cabin Comfort" equipment is being furnished for the newest planes of Douglas, Lockheed, Consolidated Vultee, Boeing, North American, Republic and Northrop.

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the development of metal-to-wood gluing and a description of modern methods and applications of the process. Sandwich constructions for aircraft are discussed.

Flexible Organic Adhesives as Structural Elements. D. L. Loughborough and F. D. Snyder. *Mechanical Engineering*, Vol. 68, No. 12, December, 1946, pp. 1053–1055. 14 references.

Data are presented about Plastilock 500. This bonding material is an alcohol solution of synthetic organic resins. The cured bond is unaffected by temperatures from −60° to 160°F., but weakens at temperatures above 160°F. The advantages of a cement joint and the relative strengths of various methods of joining aluminum-alloy products are discussed. Particulars are given about the physical properties of Plastilock 500 joints and methods of applying this bonding material.

Effect of Catalysts and pH on Strength of Resin-Bonded Plywood. Gordon M. Kline, Frank W. Reinhart, Royden C. Rinker, and Nicholas J. DeLollis. *U.S., National Bureau of Standards, Journal of Research*, Vol. 37, No. 5, November, 1946, pp. 281–310, figs., tables. 7 references. Available also as *Research Paper, RP1748* (Govt. Printing Office, Washington, $0.15), and as *U.S., N.A.C.A., Technical Note No. 1161.*

The effects on the strength properties of plywood of various catalysts used to cure the resinous adhesives were investigated, particularly with regard to the degree of acidity developed by the catalysts in the resin film and in the plywood. The flexural, impact, and shear strengths, both initially and after aging, of birch plywoods bonded with urea formaldehyde and phenol formaldehyde resins definitely decrease as the acidity of the plywood increases, as evidenced by a decrease in pH.

Material Properties of Two Types of Plastic-Bonded Glass Cloth. Norman Rafel and Evan H. Schuette. *U.S., N.A.C.A., Restricted Bulletin No. L4H16 (Wartime Report No. L-225)*, December, 1944. 19 pp., illus. 1 reference.

The Problem of Thermal-Expansion Stresses in Reinforced Plastics. P. S. Turner. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. W-36)*, June, 1942. 29 pp., figs.

Effect of pH on Strength of Resin Bonds. R. C. Rinker, F. W. Reinhart, and G. M. Kline. *U.S., N.A.C.A., Advance Restricted Report No. 3J11 (Wartime Report No. W-46)*, October, 1943. 22 pp., figs.

Recent Advances in Plastics; Developments in Theory and Practice. N. J. L. Megson. *British Plastics*, Vol. 18, No. 210, November, 1946, pp. 476–483. 17 references.

Materials—Protective Coating

Procedure Used at Aluminum Research Laboratories for Determining Type of Attack in Some Aluminum Alloys. C. J. Walton and F. Keller. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. W-34)*, August, 1942. 13 pp., figs. 5 references.

New Surface Treatment for Aluminum. J. Anthony. *The Iron Age*, Vol. 158, No. 23, December 5, 1946, pp. 65–67, illus.

Medicine

Pilot-Airplane Integration. M. C. Shelesnyak. *Aero Digest*, Vol. 53, No. 6, December, 1946, pp. 44, 45, 122, 125, 126, illus.

Following a brief review of the equipment developed for protecting personnel against the effects of altitude, temperature changes, and acceleration, the measures that will have to be taken to enable men to operate the higher-speed aircraft of the future are considered. It is necessary to redesign the controls to permit the pilot to occupy the prone position in which he can best withstand the acceleration of high-speed flight, and further developments are needed in automatic pilot-ejection mechanisms for emergency escapes to avoid violent tumbling or spinning. Problems of vision at great speeds can be solved by electronic apparatus, to make it possible to fly entirely by instruments. Other problems are vibration and noise at transonic and supersonic speeds, and the effects of noxious gases from rockets and jets. Suggestions are made for improving cabin pressurization, protective clothing, and comfort features for flights of long duration.

The History and Development of the Biographical Inventory. National Research Council, Committee on Selection and Training of Aircraft Pilots. *U.S., Civil Aeronautics Administration, Division of Research, Report No. 70*, October, 1946. 47 pp., tables.

A study of the application of data about the personal history, background, environment, and interests of applicants for flight training as a measure of the mental ability of such applicants, with a view toward establishing a rating for their proficiency as civilian or military pilots.

Meteorology

Pressure Measurements in the Upper Atmosphere. Nolan R. Best. *Paper presented at I.A.S. 15th Annual Meeting*, New York, January 28–30, 1947. (For abstract see "I.A.S. Briefs" on page 27 of this issue, February, 1947.)

Discussion of the Possibility of Weather Control. V. K. Zworykin. *Paper presented at I.A.S. 15th Annual Meeting*, New York, January 28–30, 1947. (For abstract see "I.A.S. Briefs" on page 27 of this issue, February, 1947.)

An Investigation of Kibel's Method of Forecasting. B. Haurwitz. *American Meteorological Society, Bulletin*, Vol. 27, No. 9, November, 1946, pp. 499–508, figs.

Contrary to the experience of Russian meteorologists, attempts made at M.I.T. to apply Kibel's method to the construction of prognostic pressure charts have not been successful. An explanation of the reason requires more information about the practical work done by Russian meteorologists. It appears from Izvekov's paper that the practical side of Kibel's method has been developed further since Kibel's original paper was published. Because there was no information regarding further developments, the study was based on Eq. (9) of Izvekov's paper. It is unlikely, however, that a mathematical transformation of this equation would yield expressions that could be determined with greater accuracy.

Professor I. A. Kibel's Theoretical Method of Weather Forecasting. B. I. Izvekov. Translated by Alexander G. Alexeef. (*Meteorologia i Gidrologia* (Leningrad), 1941, No. 5, pp. 15–25.) *American Meteorological Society, Bulletin*, Vol. 27, No. 9, November, 1946, pp. 488–497.

The Meteorological Conditions in the Upper Reaches of the Radiosonde Flights over the United States. I, II. Oliver R. Wulf, Mary W. Hodge, and Stanley J. Obloy. *Chicago, University, Department of Meteorology, Miscellaneous Reports Nos. 20, 21*, 1946. 51, 45 pp. $1.00, $0.75.

The Variation with Height of the Non-Geostrophic Component of the Wind. Joseph Vederman. *American Meteorological Society, Bulletin*, Vol. 27, No. 9, November, 1946, pp. 532–536, figs. 3 references.

The general equation of motion for horizontal, frictionless motion is differentiated with respect to height. The total vertical wind shear is shown to be composed of five parts; the shear of (a) the geostrophic wind, (b) the local derivative, (c) the wind component due to the convergence or divergence of the streamlines, (d) the cyclostrophic component of the wind, and (e) the wind component associated with the vertical velocity. Except for the last term, which is smaller, these terms may be of the same order of magnitude.

Why Subterranean Isobars?: The 5000-Foot vs. Sea-Level Chart over the Plateau Region. W. Boynton Beckwith. *American Meteorological Society, Bulletin*, Vol. 27, No. 8, October, 1946, pp. 438–443, charts. 4 references.

Into the Thunderstorms: Scientific Research, Using Airplanes and Gliders, Feels the Pulse of Thunderstorms. Alexis Dawydoff. *Air Trails*, Vol. 27, No. 4, January, 1947, pp. 29–33, 104–110, illus.

Meteorology for the Private Pilot. II.—Reading the Weather. Mac Weir. *Aircraft and Airport*, Vol. 8, No. 10, November, 1946, pp. 50, 52, 54, 56.

AAF Hurricane Reconnaissance, Western Pacific, 1945. Nicholas H. Chavasse. *American Meteorological Society, Bulletin*, Vol. 27, No. 9, November, 1946, pp. 510–518, illus.

A Remarkable Cloud-Wave Panorama. Donald M. Swingle and Raymond Wexler. *American Meteorological Society, Bulletin*, Vol. 27, No. 9, November, 1946, pp. 519–522, figs.

Where to Get Weather. *Air-Sea Safety* (Washington), Vol. 1, No. 1, November, 1946, pp. 57–62. A list of the radio stations that broadcast weather reports of the U.S. Weather Bureau.

Nine Nations Act on Ocean Weather Station Program. *Air-Sea Safety* (Washington), Vol. 1, No. 1, November, 1946, pp. 25–32, illus.

The work of the ocean weather stations now operated by the Coast Guard is described. An international agreement for the

American Airlines had a shielding problem

"American Metal Hose" *found the answer*

THE PROBLEM:

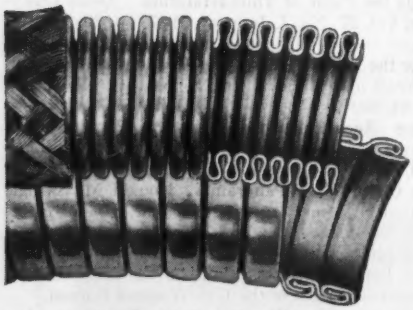
Ever since high frequency radio had been installed in aircraft, adequate ignition shielding had been a problem—fatigue cracking of the flexible metal shielding caused by continual vibration; moisture penetration of the conduit, causing electrical leakage and resulting in ignition failure, interrupted radio communication and schedule delays.

THE SOLUTION:

The answer to these difficulties was provided by the HTCD Shielding Conduit developed by the American Metal Hose Branch of The American Brass Company. Here is a strong, tough, corrosion and vibration-resistant, moisture-proof flexible metal tubing constructed of interlocked stainless steel core, with a covering of two specially-woven layers of tinned copper wire braiding, with brass ferrules, stainless steel nuts, and, finally, a molded Neoprene jacket.

THE RESULT:

American Airlines' flight-testing of this new shielding conduit revealed electrical characteristics never before approached in practice. After 3,712 hours and 42 minutes of operation, the conduit was in such excellent condition that tests were discontinued and it was accepted as standard. In addition, detailed cost studies revealed that the new shielding conduit cost approximately *half as much* per hour of operation as that previously used—and its ultimate life is still unknown.



For practical industrial applications of American Seamless Flexible Metal Tubing and Interlocked Flexible Metal Hose, illustrated above, write for Publication SS-50.

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operation and maintenance of the ocean stations, in which the United States and other nations participated, is outlined.

Military Aviation

A Review of Recent Progress in Aircraft Gun Design As It Affects Installation in Aircraft. G. F. Wallace. *The Royal Aeronautical Society, Journal*, Vol. 50, No. 432, December, 1946, pp. 986–997, figs.

The design and performance of early types of aircraft guns—the German M.G.17, the 20-mm. Hispano cannon, and German 20-mm. cannon are discussed. Gun designers should break with land-service traditions and consider aircraft guns purely as aircraft equipment, taking full advantage of the more favorable conditions appertaining to aircraft installations. This would make possible a considerable advance in aircraft gun design, especially in the rate of fire and reliability.

Victory and the B-29's. William D. Lanier, Jr. *United States Naval Institute, Proceedings*, Vol. 72, No. 12(526), December, 1946, pp. 1563–1567, illus.

Bomb Disposal. I, II. H. J. Gough. *The Engineer*, Vol. 182, Nos. 4741, 4742, November 22, 29, 1946; pp. 465–467; pp. 484–486; illus.

Radio Proximity-Fuze Development. W. S. Hinman, Jr., and Cledo Brunetti. *The Institute of Radio Engineers, Proceedings, and Waves and Electrons*, Vol. 34, No. 12, December, 1946, pp. 976–986, figs.

Markers, Marine (Coloured Light). W. J. Bolitho. *Australia, Royal Australian Air Force, Aircraft Performance Unit No. 1, Laverton, Armament Report, Detail No. 628/A/204*, July, 1945. 6 pp., illus.

The results of tests of an electrical type of marine marker developed by Maribyrnong Supply Laboratories, to determine its suitability for service use as a floating signal for mine laying at night.

Air Support. Roger Montgomery. *Aeronautics*, Vol. 15, No. 5, December, 1946, pp. 36–41, illus. The organization and activities of the (British) School of Air Support.

Royal Air Force Reserves. Norman Macmillan. *Aeronautics*, Vol. 15, No. 5, December, 1946, pp. 26–28.

Navigation

Simple Computation of Distances over the Earth. W. Sitterly and J. A. Pierce. *Navigation*, Vol. 1, No. 4, December, 1946, pp. 62–67, figs. 3 references.

Radar aids to navigation and those of hyperbolic type (such as loran) depend upon an accurate knowledge of the distances between points on the earth's surface. For the calculation of distances greater than a few miles the assumption that the earth is a sphere is unsatisfactory. A simplified method of computing approximate distances over a spheroidal surface is presented. By this method the distance is first computed as a spherical arc, then multiplied by a factor to convert it to linear units on a sphere of radius equal to the equatorial radius of the earth, and finally corrected to the spheroid by addition or subtraction of a small quantity.

Altimetry Navigation. I. *New Zealand, Air Department, Information Circular*, Vol. 3, No. 32, October, 1946, pp. 8–11.

A review, based on British and American literature, of the technique of obtaining position lines or drifts by comparison of the readings of radar and barometric altimeters, and the closely related procedures of "single heading flight" and "in-flight forecasting."

Determining Drift by Timing and Bearing. Paul M. Hummel. *United States Naval Institute, Proceedings*, Vol. 72, No. 526, December, 1946, pp. 1586, 1587, fig.

Details are given about a method of determining the wind drift while in the air, which is an adequate substitute for a drift meter whenever a fixed object is visible. The method requires a pelorus or similar instrument for taking relative bearings and an accurate watch.

A New Sextant. William H. Holman, 3d. *Navigation*, Vol. 1, No. 4, December, 1946, pp. 73–77, figs.

Observation errors in the use of the ordinary marine sextant can be attributed largely to the oscillating horizon that occurs when sights are taken from ships in a rough sea, the uncertainties of angular measurements to a hazy horizon, and the observer's personal error. It is impossible to measure the altitude of a celestial body accurately in seconds if the horizon itself is oscillating in seconds. A sextant, which uses the natural horizon as a basis for the reference line, is designed to eliminate these observation errors, thereby increasing accuracy, reducing the time required for observations, and saving paper work. It may be used in aircraft also, where it will reduce the time required for observations by the bubble sextant.

New Bendix Flightweight Air Navigational Plotter. *Bendix Aviation Corp., Bendix Radio Div., Release*, December 16, 1946. 1 p., illus.

The new Bendix Flightweight air navigational plotter is similar to the type that was standard equipment in the War Training Services Cross-Country Navigational Kit, but in a greatly improved form. The principal improvement is the 360° rotatable protractor with a rectangular grid to facilitate alignment with the meridians. This permits operation on any position of the chart, including general north and south directions between meridians, and across the top of the chart. The rotatable protractor provides quick, mechanical corrections for variation, deviation, and drift; and for each course measured, the reciprocal is automatically given. It can also solve wind vector problems, and measures distances directly on Sectional, Regional, World Air and R.D.F. charts. The plotter is adaptable to all forms of air navigation, including celestial.

Bulletin No. 1. *Institute of Navigation, Technical Development Committee for Air, Polar Navigation Subcommittee*, 1946. 6 pp.

A brief review and summary of the material available for a study of the numerous problems of polar navigation, the status of the development, and the needs of the various fields. The methods and instruments that can be used in the operational phases of the work and in the scientific field are outlined. The mission of the subcommittee is (1) to act as an appraisal group for new techniques, systems, ideas, and instruments; (2) to recommend standards for operational practice; (3) to investigate the various instruments, methods, and systems of navigation in the light of actual operational experience; (4) to coordinate and sponsor a flow of information; and (5) to prepare an annual report on the rate of development, state of progress, and recommendations for further development in the fields of air navigation.

Transoceanic Navigation. Guy L. Arnold. *Air-Sea Safety* (Washington), Vol. 1, No. 1, November, 1946, pp. 6–10, illus. The various methods of navigation are reviewed, with descriptions of the work and the instruments used. Radio aids are included.

Standardizing Radio Navigation Systems. *The Aeroplane*, Vol. 71, No. 1855, December 13, 1946, pp. 709, 710.

A condensed version of a report by the Radio Technical Division of the Provisional International Civil Aviation Organization, containing recommendations for the standardization of radio equipment on an international basis.

Pressure Pattern Flying and Altimetry Navigation. *Navigation*, Vol. 1, No. 4, December, 1946, p. 93. Excerpts from the Institute of Navigation Sub-Committee Report.

Japanese Almanacs. Ralph F. Haupt. *Navigation*, Vol. 1, No. 4, December, 1946, pp. 77–82, tables.

Radio Aids to Air Navigation: Decisions of P.I.C.A.O. Technical Division. I, II. *Modern Transport*, Vol. 56, Nos. 1447, 1448, December 7, 14, 1946; p. 7; p. 7.

Catalogue W-2. *Weems System of Navigation*, Recd. December 23, 1946. 24 pp., illus. Various navigation instruments are described and their uses explained.

Air Materiel Command's Program in Radio and Radar Navigation. Vernon I. Wiehe. *Navigation*, Vol. 1, No. 4, December, 1946, pp. 82–84.

Parachutes

Determination of Towline Tension and Stability of Spin-Recovery Parachutes. John H. Wood. *U.S., N.A.C.A., Advance Restricted Report No. L6A15 (Wartime Report No. L-267)*, March, 1946. 34 pp., figs. 6 references.

New Type Parachute is Service Tested. *Aviation News*, Vol. 6, No. 24, December 9, 1946, pp. 9, 10.

A new type of parachute, with a wedge-shaped vent in the canopy, has been tested by Wright Field engineers and is now being service tested. It is reported to offer promise of being completely controllable and easily steerable.

No need for a "prop"!

There's no more need to "prop" a plane than to crank a car—now that Delco-Remy electrical equipment is available on popular makes of light planes. Electric starting with its ease, speed and safety adds pleasure to flying. The Delco-Remy generator keeps the battery charged and supplies ample current for lights, radio and accessories. Delco-Remy electrical equipment brings to the air all the efficiency and dependability that have made it the leader on land and sea.

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WHEREVER WHEELS TURN OR PROPELLERS SPIN

Photography

The Transparency Method of Depth Determination. R. H. Thomson. *Australia, Royal Australian Air Force, Aircraft Performance Unit No. 1, Laverton, Performance Report, Detail No. 814/A/261*, May, 1946. 39 pp., illus.

Trials carried out on the Australian coast have shown that the transparency method is satisfactory in determining beach gradients and water depths when the water is not pigmented. Simultaneous vertical photographs of beaches were taken from a Mosquito XVI airplane fitted with two 14-in. F24 cameras. Densities of points on the negatives were measured, using a spectral microphotometer, and from these densities the depth of the points was calculated. In all but one case the results varied less than 5 per cent from the depth figures established by survey, and that maximum error was only 5.5 per cent, caused by a significant difference in the material of the sea bed and hence in its effective reflectivity.

Private Flying

Can You Afford a Plane: A Practical Cost Formula for the Private Owner. Neil B. Berboth. *Air Force*, Vol. 29, No. 11, December, 1946, pp. 32–35, 63, illus.

Lightplanes for Businessmen. Clintie Kenney. *Flying*, Vol. 40, No. 1, January, 1947, pp. 32, 33, 62, illus.

Production—General

Production Planning Data Purchased from Industry by AMC. *Air Matériel Command, Public Relations Office, Wright Field, Release*, December 17, 1946. 2 pp.

The purchase of production-planning data from industry is one of the latest air-industrial preparedness planning projects. Twenty-two aircraft and aeronautical equipment manufacturers are currently preparing planning studies for the Air Matériel Command, which will reimburse the contractors. These studies, when completed, will be thoroughly analyzed by the Army Air Forces, in cooperation with the Bureau of Aeronautics, prior to the formulation of production plans that could be immediately put into effect in the event of a future emergency. This initial expenditure covers the purchase of preliminary planning data covering such aircraft items as fighters, light and heavy bombers, light and heavy transports, jets, and guided missiles. Planning data for such aeronautical equipment as jet engines, landing gears, propellers, automatic pilots, and bomb sights are similarly being procured. The second part of the program will be the development of production plans for specific air weapons.

Bristol Type 167. II. *Aircraft Production*, Vol. 8, No. 98, December, 1946, pp. 561–569, illus. (Cf. AER 1/47:56.)

The machining and forming of the extruded stringers and the design of the main fuselage assembly. Although fuselage, mainplane, and tailplane are being built as a single unit, this assembly of the main fuselage may be regarded as a single phase.

The de Havilland Dove in Production. *Aircraft Engineering*, Vol. 18, No. 213, November, 1946, pp. 396, 397, illus. Illustrations and brief descriptions of production methods.

Ultra-Large Flying Boats. *Aircraft Production*, Vol. 8, No. 98, December, 1946, pp. 584–587, illus. A review of production methods utilized in the building of the Martin Mars and JRM-1.

Building the XB-35. D. G. Leland. *Western Flying*, Vol. 26, No. 12, December, 1946, pp. 20, 21, 34, illus. (Cf. AER 6/46: 114.) Tooling and manufacturing problems encountered in the production of the Northrop XB-35 flying wing.

Carving Costs in Hydraulics Production. *Aviation*, Vol. 45, No. 11, November, 1946, pp. 56, 57, illus.

Quality and the Engineer. Merton Hill. *Northwestern Engineer*, Vol. 5, No. 4, December, 1946, pp. 8, 32, 34, 36, 40, illus. Basic principles of the science of quality control are discussed, and examples of various inspection procedures are given.

Use of Instruments in Quality Control Work. Joseph Manuele. *Instruments*, Vol. 19, No. 12, December, 1946, pp. 714–717, illus.

Production Methods

Precision Cast Finned Cylinders. E. I. Valyi. *Materials & Methods*, Vol. 24, No. 6, December, 1946, pp. 1450, 1451, figs.

In the manufacture of finned cylinders for aircraft engines from cast or forged blanks, the limitations of machining economy prevent consideration of many cooling-fin shapes, spacings, and sizes that otherwise might offer interesting design possibilities. The A. R. D. Corp. has made use of a combination of various casting methods to produce cylinder designs requiring thin layers of metal and heavy sections side by side.

Fabricating Sheet Metal Parts of Jet Engines. Harold A. Knight. *Materials & Methods*, Vol. 24, No. 6, December, 1946, pp. 1461–1465, illus.

Methods used by the I-T-E Circuit Breaker Co. for the welding of high-alloy sheet metals to produce gas-turbine parts are examined. After considerable experimentation, four types of welding were chosen: resistance seam, resistance spot, atomic hydrogen, and electric arc—selecting the type of welding best suited for each operation. Considerable ingenuity was displayed in designing a fixture for holding 14 combustion tubes in place during final assembly. Thus, although the fixture could not prevent distortion, it could keep the tube in the exact position desired in the assembly. Problems encountered in machining the stainless steel caused considerable time to be consumed in securing the correct rake and angles in the carbide tool tips. A solution to the problem of sawing the sheets was found in the use of a high-speed friction hacksaw with dull teeth. The basic functions of the I-40 jet engine with regard to the sheet metal parts are reviewed.

Seam Welding Stainless Steel Foil. *The Iron Age*, Vol. 158, No. 23, December 5, 1946, p. 76, illus. Insulation blankets for a turbojet aircraft engine were made at the Solar Aircraft Co. by seam welding stainless steel in thicknesses of 0.0015 in.

Design and Production Technique. V. A. J. Schroeder. *Aircraft Engineering*, Vol. 18, Nos. 211, 212, September, October, 1946; pp. 320–323, figs.; pp. 357–362, figs. (Cf. AER 3/46:102.)

Expansion and Contraction (in Welding); General Theory and Basic Control Procedures. R. B. Aitchison. *American Welding Society, Journal*, Vol. 25, No. 12, December, 1946, pp. 1195–1202, figs.

Development of a Two-Row High-Strength Spot-Welded Lap Joint in 24S-T Alclad Aluminum Alloy. L. M. Crawford and J. E. Pease. *American Welding Society, Journal*, Vol. 25, No. 12, December, 1946, pp. 1202–1210, figs. 1 reference.

The primary requirements were that the ultimate tensile strength of the lap joint should not exceed 50,000 lbs. per sq. in., and that the joint fracture at ultimate static load should occur in the base metal and not by shearing of the welds. The secondary purpose of the investigation was to determine optimum values of (1) spot spacing, (2) edge margin, (3) row spacing, and (4) spot strength to be used in fabricating the joint. The test setup, test procedure, and test results are presented. By incorporating the most favorable values of spot spacing, edge margin, row spacing and spot strength, a two-row spot-welded lap joint exceeding 50,000 lbs. per sq.in. ultimate tensile strength was developed for each of the sheet-thickness combinations tested. At ultimate static load, all joints fractured by failure in the base metal along one row of spot welds.

Resistance-Welding Aids in the Production of Jet Engines. Frank G. Harkins. *American Welding Society, Journal*, Vol. 25, No. 12, December, 1946, pp. 1175–1178, illus.

Particular reference is made to the manufacture of elbows made of Type 347 stainless steel 0.025 in. thick. Cost savings resulting from the use of resistance welding in place of atomic hydrogen hand welding are cited. Seam welding was made possible by using two "gooseneck" lower horns, one inside and one outside (made from bronze castings), and by providing $^3/_8$-in. lap between the half stampings. Welding techniques and welding machine setups for carrying out the work are described.

The Argonarc Process for Welding Magnesium and Aluminium Alloys and Stainless Steel. R. E. Dore. *Sheet Metal Industries*, Vol. 23, No. 236, December, 1946, pp. 2405–2415, 2420, illus.

The fluxes suitable for use in welding magnesium-rich alloys are extremely corrosive and great care must be taken to remove flux residues after welding. The development of the Argonarc method of welding, in which the molten metal is shielded by an inert gas, has obviated this flux trouble. The equipment required for Argonarc welding is listed. Consideration is given to a.c. and d.c. welding, welding technique for magnesium, the welding of stainless steel, and automatic Argonarc welding. Results of welding tests on magnesium alloys and other metals are tabulated and discussed. The metallic structures of such welds are illustrated.

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This flash-type boiler (located in the engine exhaust stack of airliners) provides a uniform cabin temperature of 70° F.

Heated by the exhaust, the sealed-in water supply is converted into steam for cabin heaters. After giving up its heat, the steam is condensed and returned to the boiler.

These boilers, made entirely of one metal, must stand stack temperatures in excess of 1500° F. In addition, they must endure the sudden shock of the 200° F. return water. And, they must remain free from scale and corrosion for top efficiency.

*Inconel** (an 80 Nickel—14 Chromium alloy) has long been specified for this tough job. The reason is readily apparent. Just look at the boiler shown. After 1100 hours' service, it is still in almost perfect condition.

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Or, if you have any application where you want long life at high temperatures, investigate Inconel. INCO Technical Service is always ready to help you work out individual designs.

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- . . . stand up under the corrosive attack of high-octane exhaust
- . . . permit a strong, yet lightweight, unit that can withstand the vibration stresses
- . . . endure the thermal shock of sub-zero intake air and the hot blast of exhaust gases
- . . . undergo all the fabricating operations that must be employed to shape the parts and assemble them into a complete unit.

These requirements are all met successfully by *Inconel*—an INCO Nickel Alloy

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Here Is Information on Eutectic. *Eutectic Welding Alloys Corp., Release,* December 16, 1946. 4 pp., illus.

The booklet gives specific applications in which "low temperature" welding alloys can be used to good advantage, suggests which welding rod or electrode is best suited for the particular job, and lists complete technical information about the welding rod recommended, including bonding and remelting temperatures, Brinell hardness, strength, color match, etc.

Strengthening Metal Parts by Shot Peening. I, II. H. F. Moore. *The Iron Age,* Vol. 158, Nos. 22, 23, November 28, December 5, 1946; pp. 70–76, illus.; pp. 81–86, figs. 11 references.

Aluminum Cleaning Procedures. Joseph S. Brady. *The Iron Age,* Vol. 158, No. 25, December 19, 1946, pp. 76–79, illus.

Machining of Stainless Steels. W. H. Crisp and W. Burnan. *Aircraft Production,* Vol. 8, No. 11(97), November, 1946, pp. 529–532, figs. Rough turning, drilling, reaming, tapping, threading, and milling.

The Effect of Various Surface Conditions on Press Fits of Steel Bushings and 17S-T Aluminum-Alloy Fittings. E. C. Hartmann and J. F. Reedy. *U.S., N.A.C.A., Advance Restricted Report (Wartime Report No. W-35),* December, 1942. 15 pp., figs. 1 reference.

High-Speed and Super-Speed Cutting of Metals. I. M. Besprozvany, A. N. Danielian, A. V. Pankin, and N. I. Reznikov. (*Vestnik Inzhenerov i Tekhnikov,* No. 2, 1946, pp. 65–73.) *The Engineers' Digest,* Vol. 3, No. 11, November, 1946, pp. 565–567, figs. 7 references. (An abridged translation.)

Sand Control in Light-Alloy Foundries. E. Carrington. *Light Metals,* Vol. 9, No. 107, December, 1946, pp. 688–695. The properties of foundry sand, the principles of sand control, the estimation of the moisture of foundry sand, and the test for the green strength of sand.

The Relation of Template Measurements to Those of Conforming Materials. J. H. Mort. *Sheet Metal Industries,* Vol. 23, No. 236, December, 1946, pp. 2399, 2400, table. 1 reference.

One engineering problem arising during the war was the calculation of the additional weight that would be imposed when armor plate not embodied in the original aircraft design was proposed. In the determination of these modifications it was customary to make mock-ups of the additional armor, using sheet steel, duralumin, plywood, etc., as templates. When the design of the templates was approximately rectangular, it was a simple matter to compute the equivalent weight of armor plate, but frequently the additions would be composed of numerous small pieces of irregular shape and the measurement of their areas by planimeter would be tedious work. In such cases it was found that by weighing the templates, the equivalent weight of armor plate could be readily determined. The methods and formulas used are presented.

Broaching; A Review of Tool Designs and Practice. E. Percy Edwards. *Aircraft Production,* Vol. 8, No. 98, December, 1946, pp. 570–573, figs.

The main classifications for types and forms of broaches are listed. The characteristics of standard types of broaches are discussed, together with their design requirements. Experience has shown that the most satisfactory material for broach manufacture is 18-4-1, with closely controlled carbon content. Cutting speeds vary over a wide range. The practice should be to keep them as high as possible but, usually, known factors affect a choice of speed. Sulphurized cutting oils are the best for broaching. In dealing with materials of the stainless class the addition of carbon tetrachloride will usually be found advantageous. The maintenance of broaching tools is discussed.

Profile and Surface Analysis. II. *Aircraft Production,* Vol. 8, No. 98, December, 1946, pp. 557–560, illus. (Cf. AER 1/47:56.)

Further applications of combined mechanical and optical methods for checking by projection developed by D. Napier and Son, Ltd. A simple device for checking gear-tooth velocity is used in determining the amount of correction to be applied to tooth forms in order to compensate for tooth deflection under load. Equipment for testing the valve sleeves of Napier engines includes apparatus for detecting irregularities in the surface of the sleeves, for obtaining records of bore surface in a direction parallel with the cylindric axis of the sleeve, and for recording a linear development of the circumference of the external surface.

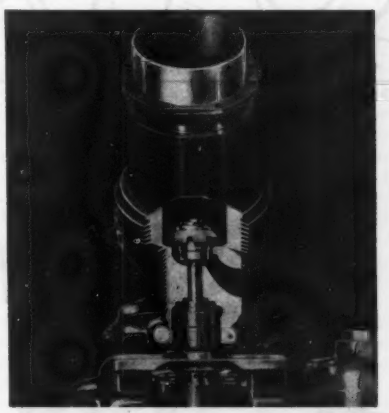
Location of Internal Defects by Supersonics. J. W. Dice. *Instruments,* Vol. 19, No. 12, December, 1946, pp. 718–722, illus.

The Sperry supersonic reflectoscope sends supersonic vibrations through the material under test and measures the length of time it takes these vibrations to penetrate the material, reflect from the opposite side, or from an internal defect, and return to the sending point. The pattern on an oscilloscope screen indicates visually the location of any defects. Details are given about the method of generating the high-frequency impulses and the functions of the various circuits.

Production Tools and Equipment

Wadell Diamond Boring Machines for Master & Articulated Rods. *Wadell Engineering Co., Release,* Recd. December 20, 1946. 8 pp., illus.

The machine is designed and constructed so that both bearings of the articulated or master rod may be bored in the same setup. Three sets of boring-bar supports are provided to insure that each boring bar is rigidly and accurately supported on either side of the bearing that is being bored. All boring bars are hardened, ground, and lapped. Boring-bar transmissions have individual controls for both revolution and feed travel. The locating mechanism for the large end of the master rod is a positive nesting device designed to assure perfect parallelism and concentricity with the articulated rod pins. Two types of cutting tools are furnished with the machine. Cemented carbide tools are used for the roughing bars and specially designed diamond cutting tools for the finishing bars. At least 5,000 bearings can be bored without redressing the diamond, and often 10,000 to 20,000 bearings may be bored without any attention to the diamond.



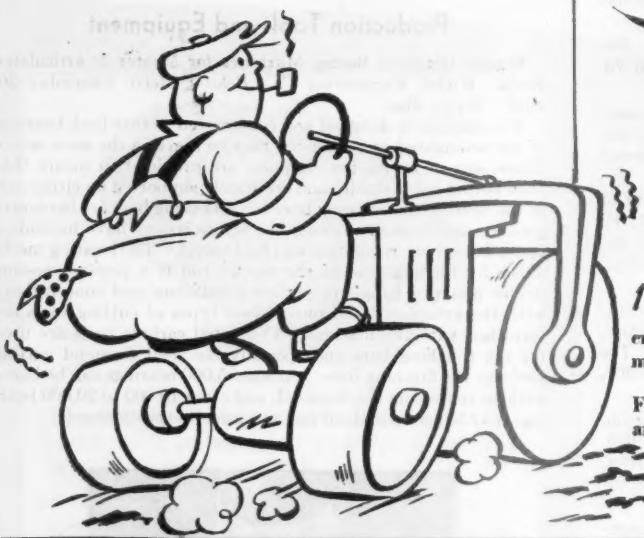
The Wadell valve-seat grinder. (See "Wadell Valve-Seat Grinder for Air Cooled Aircraft Engines.")

Wadell Valve Seat Grinder for Air Cooled Aircraft Engines. *Wadell Engineering Co., Release,* Recd. December 20, 1946. 4 pp., illus.

The Wadell grinder grinds both intake and exhaust valve seats, whether made in hard or soft inserts, to a perfect concentricity and at a true angle with the center of the valve guide. The one model is used for both original valve-seat grinding on the production line and for regrinding valve seats in maintenance shops. It uses a specially designed free-cutting abrasive wheel mounted on a high-speed spindle that is eccentrically revolved in a slow-turning spindle sleeve. The spindle sleeve, in turn, is guided by the valve guide in the cylinder. The outer spindle sleeve passes through the valve guide and aligns the center of the grinding wheel with the center of the valve guide. A special valve-guide sleeve is inserted in place in the regular valve guide. The wheel spindle goes through, and locates in this valve-guide sleeve, thus locating the cylinder in exact position on the machine, the same as the actual valve would be located in the head.

"Flowrator" New Trade Name for "Rotameter." *Fischer and Porter Co., Release,* November 27, 1946. 1 p. The company, manufacturers of variable-area type flowmetering instruments heretofore called Rotameters, has recently announced adoption of the trade-mark name Flowrator to designate its product.

EXTRA weight may be valuable on the ground



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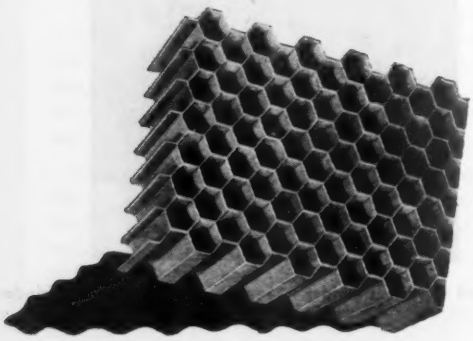
For excess weight has no place in this sleek new amphibian which has a top speed of over 200 mph, cruises at 180 mph and flies 700 to 1200 miles non-stop.



2. Great weight-saving was made in the Grumman Mallard through careful engineering and the extensive use of Armorply Honeycomb — a lightweight structural material — for doors, floors, toilet covers, partitions, etc.

Made of impregnated cloth, paper, Fiberglas or other materials, this Honeycomb core has an amazing strength/weight ratio—weighing as little as 4 lbs. per cu. ft. Faced with aluminum alloys, stainless steel, plastic or wood veneers, Honeycomb sandwich panels can be used in any practical thickness.

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New Thread Ground Micrometric Expanding Milling Spacers. *Aircraft Engineering*, Vol. 18, No. 213, November, 1946, p. 395, illus.

Information is given about the special steel used in the construction of the spacers (manufactured by Euco Tools Ltd., London); their design, which provides for infinitely variable adjustments; and proper methods of employing them. The methods for determining whether the fine threads can withstand the pressure used in tightening the cutters onto the milling machine are described.

New Shop Accessories, Equipment and Supplies. *Aviation Maintenance & Operations*, Vol. 6, No. 6, November, 1946, pp. 140 ff. (10 pp.), illus. Descriptions of about 35 items.

New Inspection and Research Instrument. *The Faxfilm Co., Release*, Recd. December 23, 1946. 10 pp., illus.

The Faxfilm Dual Projection Unit, Model D-30, provides a quick, accurate comparison of a production finish with a standard finish, and may be used with curved and conical shapes and inside or outside diameters as well as on flat surfaces. It is portable, weighing only 27 lbs., and requires only 2 sq.ft. of bench space. By the Faxfilm process a plastic replica of a surface is made in less than a minute and projected in a microprojector to produce a three-dimensional image of the surface at from 10 to 200-diameter magnification. Films of a standard finish and of a production finish are projected by two microprojectors mounted at the top of the case, the images appearing side by side on a screen at the base of the case.

Propellers

Vibration of Stationary and Rotating Propellers. E. R. Love, J. P. O. Silberstein, and J. R. M. Radok. *Australia, Council for Scientific and Industrial Research, Division of Aeronautics, Report No. SM. 48*, May, 1946. 111 pp., tables. 18 references.

After a comparative survey of other significant research work in propellers, a theory is developed for small vibration of a propeller idealized according to specified assumptions more general than those of previous studies, the propeller being supposed to vibrate about a stationary equilibrium position. The integral equations so obtained are new, being not only more general than previous equations for propeller vibration but also essentially different in character. Transformations showing their relations with previous equations are given. The theory is extended to apply to the idealized propeller vibrating about a rotating equilibrium position, not only when the hub is driven at uniform speed but also when the driving shaft is in torsional vibration. This extension is developed independently, directly from dynamic principles, without the usual use of Southwell and Gough's approximate formula. A method is given for solving the equations of the theory approximately for a given propeller, leading to the mechanical impedance of the propeller at its hub at any frequency. A numerical application of the theory is reported, giving impedance-frequency relations for a de Havilland propeller.

Strain Gauge Test of a Fluttering Propeller in a Wind Tunnel. F. Clifton and L. H. G. Sterne. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2072*, January, 1943. 6 pp., figs.. 1 reference. British Information Services, New York. $0.45.

A four-bladed propeller designed for the Spitfire airplane was tested on the No. 3 Spinning Tower at the Royal Aircraft Establishment and was found to flutter at five of the six pitch settings at which the tests were made. The propeller was run in the large wind tunnel, after two of the blades had been removed and electrical resistance-wire strain gages had been fitted to the remaining blades, to investigate whether the flutter motion consisted of both flexural and torsional oscillations, and also to measure the vibratory strains that occurred. The test methods are outlined and the results are plotted on graphs.

De Havilland Manually-Variable-Pitch Propellers. *The Canadian de Havilland Gazette*, Vol. 1, 1946, p. 4, illus.

The features and advantages of a manually variable-pitch propeller for the lighter categories of aircraft are set forth. The propeller is suitable for single and multiengined planes. The design is a departure from standard de Havilland practice in that wooden blades are employed and that the hub comprises only one major component—the barrel, which is designed to carry the combined torque, thrust, and centrifugal loads.

Wind-Tunnel Vibration Tests of a Four-Blade Single-Rotating Pusher Propeller. Mason F. Miller. *U.S., N.A.C.A., Advance Restricted Report No. 3F24 (Wartime Report No. L-327)*, June, 1943. 24 pp., figs. 4 references.

The Theory of Propellers. I—Determination of the Circulation Function and the Mass Coefficient for Dual-Rotating Propellers. Theodore Theodorsen. *U.S., N.A.C.A., Advance Confidential Report No. L4H03 (Wartime Report No. L-490)*, August, 1944. 52 pp., illus. 3 references.

The Effect on Stability and Control of a Pusher Propeller Behind Conventional Tail Surfaces as Determined by Tests of a Powered Model in the Free-Flight Tunnel. John P. Campbell and Thomas A. Hollingworth. *U.S., N.A.C.A., Advance Confidential Report (Wartime Report No. L-220)*, January, 1943. 36 pp., illus. 1 reference.

Method of Calculating Performance of Dual-Rotating Propellers from Airfoil Characteristics. Irven Naiman. *U.S., N.A.C.A., Advance Restricted Report No. 3E24 (Wartime Report No. L-330)*, May, 1943. 42 pp., figs. 8 references.

Airscrew Gyroscopic Moments. G. Bock. (*Luftwissen*, Vol. 8, No. 3, March, 1941.) (Reprint of R.T.P. Translation, No. 1333.) *U.S., N.A.C.A., Technical Note No. 1099*, September, 1946. 7 pp., figs. 3 references.

Radio

A Comparison of VHF and SHF Bands for Aircraft Communication. E. G. Fubini and W. A. Hosier. *Airborne Instruments Laboratory, Inc., Report No. 130-1*, September, 1946. 37 pp., figs.

This report contains some of the conclusions obtained from a study made for the Navy Bureau of Aeronautics of the basic factors involved in the choice of the optimum frequency band for air-to-ground communications. It deals specifically with a comparison between frequencies in the 225–400 megacycle range and frequencies in the 4,400–5,000 megacycle range. More emphasis is given to the comparison between regions to which satisfactory service can be supplied at the two frequencies than to the problem of supplying the best possible service to a point or a region of space within range of the system. The results would change if the intelligence to be transmitted required a frequency band substantially wider than that of the audio frequencies; the results would be completely different if channels carrying signalling intelligence of the coded-pulse type or directional communications were considered.

A Preliminary Analysis of Supplementary Aircraft Communication Systems. Frank B. Brady and Eugene G. Fubini. *Airborne Instruments Laboratory, Inc., Report No. 516-1*, October, 1946. 10 pp., fig.

The present congestion in many aircraft radio channels could be greatly alleviated without recourse to new frequency bands or new systems of modulation. It is suggested that active development be carried on to find more efficient methods of using existing spectrum allocations. A recent study, the preliminary conclusions of which this report summarizes, leads to the belief that as far as ground-to-air communications are concerned, most of the effort should be exerted in the development of a satisfactory facsimile system. While specialized applications exist for teleprinters, television, and signalling systems, it is recommended that the development of facsimile be given the highest priority.

New VHF Transmitter for Ground-Air Communications. *Radio Receptor Co., Inc., Release*, December 16, 1946. 1 p., illus.

Features of the Radio Receptor TV-50-A transmitter include a removable "inverted" T transmitter unit built on a welded-steel base chassis with vertical aluminum chassis and steel front panel. All heavy components are mounted on steel with all radio-frequency circuits built on aluminum. It can be supplied for any frequency from 100 to 162 megacycles. Power output is 50 watts at 100–140 megacycles or 40 watts at 140–160 megacycles. Power input is 600 volt-amp. at 115 volts, 60 cycles. Other specifications are given.

Interference Between V.H.F. and Rebecca. K. H. Taubman. *Australia, Royal Australian Air Force, Aircraft Performance Unit No. 1, Laverton, Radar Report, Detail No. 692/19/29/R144*, July, 1945. 7 pp., figs.

The Rebecca Mk.11B (Australian) is a low-power radar set designed to operate against P frequency A.S.V. beacons and Eureka

portable beacon equipment, for army cooperation work and supply dropping. The equipment was being installed in Beaufighter aircraft and it was anticipated that mutual interference might occur between this and the V.H.F. transceiver installation. Tests were carried out to ascertain the nature of any such interference. It was found that, while the Rebecca did not interfere with the V.H.F. in any way, the V.H.F. transmitter did interfere badly with the Rebecca, when certain harmonic relations existed between the two operating frequencies.

New Aircraft and Marine Portable Radio. *Electronic Specialty Co., Release*, December 9, 1946. 1 p.

The Ranger Model 118 Portable, is a 5-tube (plus rectifier) superheterodyne a.c.-d.c. receiver with limited automatic volume control. It can be used with speaker or headphones on broadcast (540–1550 kc.) and long-wave bands (195–410 kc.), which include aircraft and marine beacons, radio-range stations, and airport control towers. The "A" and "B" batteries can be recharged while the receiver is in operation on 110 volts a.c. or d.c., thus extending the life of the batteries five to ten times, or more. The receiver is $10^{3}/_{8}$ by 7 by 6 in. and weighs 7 lbs. 8 oz.

Personal Flying Radios. *Flying*, Vol. 39, No. 6, December, 1946, pp. 96, 97, illus. Specifications of 32 models, all selling for less than $300.

Aircraft Radios. *Skyways*, Vol. 5, No. 12, December, 1946, pp. 130–132, 134, 136, 138, 140, 142, illus. Brief descriptions of 20 models.

Static and the Airplane Radio. J. William Welsh. *Flying*, Vol. 40, No. 1, January, 1947, pp. 36, 37, 82, illus.

PICAO Demonstrations of Radio Aids to Civil Aviation. G. Guanella. *Interavia* (Geneva), Vol. 1, No. 7, October, 1946, pp. 58–62, figs.

A report on the radio equipment for air navigation exhibited and demonstrated for delegates from the Provisional International Civil Aviation Organization by the British Ministry of Civil Aviation, contains a general account of the apparatus displayed and brief descriptions of its operation. The equipment is classified according to use as long-distance navigation systems, short-range navigation aids, and distance-indication equipment.

Altitude and Cold Chamber for Testing Radio Tubes. *General Electric Co., Release*, Recd. January 3, 1947. 2 pp.

To assist in the design, test, and development of electronic tubes that will operate efficiently at an altitude of 80,000 ft., General Electric engineers have constructed a new tube-testing chamber that will produce temperatures ranging from −100° to 170°F. A temperature as high as 170°F. can be produced in approximately 1 hour. In addition to a 270° temperature range, the chamber can also produce a variety of humidity conditions. The test chamber simulates climbing conditions at a rate of 3,000 ft. per min.

Radio at the Paris Aero Show. Basil R. Clarke. *Flight*, Vol. 50, No. 1980, December 5, 1946, pp. 623, 624, illus.

Radar Corner Reflector Tests. *Air-Sea Safety* (Washington), Vol. 1, No. 1, November, 1946, pp. 16–19, tables.

Tests made by the Coast Guard of the radar corner reflectors when used with balsa life rafts and lifeboats are reported. Radar observations of surface targets made from a PBM aircraft and from a surface vessel are tabulated, showing the effectiveness of the equipment for rescue work.

Blinding the Invisible Eye. Harold M. Shaw. *Army Ordnance*, Vol. 31, No. 159, November-December, 1946, pp. 242–244, illus.

Several known weaknesses of radar were exploited in World War II to counteract the effectiveness of enemy radar systems. A powerful jamming transmitter developed for use against German night fighters is described.

Radar—How It Works; Its History and Wartime Development. Victor D. Burgmann. *Aircraft* (Melbourne), Vol. 25, No. 1, October, 1946, pp. 17, 18, 42, 44, illus.

Research

British Research Stations. *Flight*, Vol. 50, No. 1980, December 5, 1946, p. 635. The addresses and subjects of research of the nine principal establishments of the Ministry of Supply (Air).

Rotating Wing Aircraft

Mechanical Instability of a Two-Blade Helicopter Rotor on Anisotropic Supports. Robert P. Coleman and A. M. Feingold. *Paper presented at I.A.S. 15th Annual Meeting*, New York, January 28–30, 1947. (For abstract see "I.A.S. Briefs" on page 27 of this issue, February, 1947.)

The Bending of Rotor Blades. Alexander H. Flax. *Journal of the Aeronautical Sciences*, Vol. 14, No. 1, January, 1947, pp. 42–50, figs. 14 references.

A review of the fundamental equations that govern rotor-blade bending; indicating several possible methods of solution, together with the simplifying assumptions necessary for each; also a discussion of the analytic basis for various approximate and empiric methods, particularly Cierva's formula. Finally, an extension to hinged rotor blades of the Stuart-Myklestad tabular method of propeller-blade stress analysis is made, together with some notes on numerical calculation. The question of aerodynamic loading on the blade is not discussed.

Aerodynamic Characteristics of Four NACA Airfoil Sections Designed for Helicopter Rotor Blades. Louis S. Stivers, Jr., and Fred J. Rice, Jr. *U.S., N.A.C.A., Restricted Bulletin No. L5K02 (Wartime Report No. L-29)*, February, 1946. 23 pp., figs. 2 references.

Practical Engineering of Rotary Wing Aircraft. VI. John E. McDonald. *Aviation*, Vol. 45, No. 12, December, 1946, pp. 90, 91, figs. (Cf. AER 1/47:58.)

Continuing an analysis of vibratory phenomena in rotating wing aircraft, details of the axial motion of a rotor, the blade motion about a vertical hinge, and the effective inertia of a rotor in torsion are studied.

The Way to the Commercial Helicopter. Devon Francis. *Interavia* (Geneva), Vol. 1, No. 7, October, 1946, pp. 69–74, illus.

Early experiments with rotating wing aircraft are reviewed, tracing the evolution of aircraft for vertical or nearly vertical ascent. The contributions of the pioneers of vertical flight are outlined, bringing the account up to the present work of American builders of helicopters and the practical application of such craft.

The Helicopter Is Here to Stay. Igor Sikorsky. *Canadian Aviation*, Vol. 19, No. 12, December, 1946, pp. 62, 104, illus. (Abstract of an address.)

Helicopter Review. R. N. Liptrot. *The Aeroplane*, Vol. 71, No. 1848, October 25, 1946, p. 492, illus. (Summary of a paper.) A short history of design.

Helicopter Engineering. Alexander Klemin. *Aero Digest*, Vol. 53, No. 6, December, 1946, pp. 91, 121, illus.

The Cierva Weir W-9 experimental helicopter embodies means for offsetting the torque by the use of a laterally directed jet in the tail. A curved pipe with a jet orifice at the end projects at a right angle to the long fuselage of the craft. Air blown over the engine and the exhaust provide the jet power. The rudder pedals control the pitch of the rotor blades and also operate vanes in the orifice to control the thrust of the jet. Comments are made about that design and about a somewhat similar helicopter suggested by Harold T. Avery, of California.

The GE Gyro Glider. *Aero Digest*, Vol. 53, No. 6, December, 1946, pp. 96, 117, illus. (Cf. AER 9/46:67.)

The SG Mark VI Helicopter. *Aero Digest*, Vol. 53, No. 6, December, 1946, pp. 94, 125, illus.

The three-seat helicopter under construction by Engineering Products of Canada, Ltd., was designed for operation in the bush country of Canada. It is estimated to have a maximum speed of 105 m.p.h., cruising speed of 80 m.p.h. at 65 per cent power, vertical climb with full load of 375 ft. per min., hovering ceiling of 2,400 ft., and cruising duration of 2 hours. The four-bladed rotor is 34 ft. in diameter and is driven at 290 r.p.m. by a Franklin six-cylinder engine of 178 hp. Other details and specifications are given.

Rotating-Wing Aircraft. *Flight*, Vol. 50, No. 1978, November 21, 1946, p. 571, illus. Brief descriptions of the French Aérocentre NC.2001–2002, Bréguet 11E, SO 100, and S.N.C.A.S.E. aircraft.

Helicopters. *Aviation Maintenance & Operations*, Vol. 6, No. 6, November, 1946, pp. 136, 137, illus. Specifications of seven current and production civil models.

Stress Analysis and Structures

Force Measurements by Means of Resistance Wire Strain Gages. W. C. Randels and V. C. Plane. *Journal of the Aeronautical Sciences*, Vol. 14, No. 1, January, 1947, pp. 59–62, figs.

It is now common practice to measure forces by a spring in the form of a cantilever beam whose deflection is measured by re-

sistance-wire strain gages. In this paper, formulas and charts are given to aid in designing the beams. Several electrical circuits are analyzed. The results of some experiments on the effect of working voltage and temperature are presented.

The Separation of Principal Stresses in Photo-Elastic Analysis. E. K. Frankl. *The Royal Aeronautical Society, Journal*, Vol. 50, No. 432, December, 1946, pp. 974–984, figs. 25 references.

Fourteen analytical, graphical, and experimental methods for the separation of the principal stresses from the photoelastic stress pattern are discussed and a number of them are described in detail. Their usefulness from the point of view of the practical stress analyst is considered. Sections deal with methods based on a solution of Laplace's equation; those based on photoelastic data; and those based on the measurement of other physical factors that are proportional to the sum of the principal stresses.

Column Tests on CA-15 Wing Stringers. N. B. Joyce. *Australia, Council for Scientific and Industrial Research, Division of Aeronautics, Report No. SM. 60*, January, 1946. 47 pp., illus. 8 references.

Column tests were performed on specimens of two 24ST aluminum-alloy stringer sections that were designed for the wing structure of the Commonwealth Aircraft CA-15 fighter. The stringers were tested without attached skin. The variation of stress at failure with column length was found, and curves suitable for design use were derived. Some notes are included on the types of instability causing failure. The critical loads for local instability of an outstanding flange were found to be in agreement with previous empiric data. On the other hand, torsional and flexural instabilities occurred at somewhat lower loads than were predicted by theory, even when allowance was made for initial eccentricities. The observed loads at failure were less than the loads carried by the same stringer sections, as measured during previous compression tests on stiffened panels. The difference in load can be accounted for by considering the restraint against bending of the stringer in the plane of the sheet.

Theory of the Bourdon Tube. Elizabeth H. Mann. *Australia, Council for Scientific and Industrial Research, Division of Aeronautics, Report No. SM. 72*, July, 1946. 24 pp., figs. 13 references.

A simple theory for determining the stresses and deflection of a curved tube of elliptical cross section under a given internal pressure is devised as an extension of the work done by H. Lorenz on the theory of the Bourdon tube pressure gage. The new application assumes the form but not the amount of the distortion. On comparing the calculated deflections with experiment, they were found to be too small, ranging from two-thirds to one-eighth of the experimental values. For greater accuracy, the form of the strained tube could not be assumed but would have to be deduced from thin-shell theory.

Investigation of Biharmonic Boundary Value Problems and Two Dimensional Elasticity Equations. N. Muskelishvili. (*Mathematische Annalen*, Vol. 107, No. 2, 1932, pp. 282–312.) *Australia, Council for Scientific and Industrial Research, Division of Aeronautics, Translation No. 9*, February, 1946. 55 pp.

In the first section the complete solution is given of the fundamental biharmonic problem for the so-called "interior" problem referring to a finite domain bounded by a simple closed curve, and for the "exterior" problem for the case of the infinite domain. In the second section the solutions of the two fundamental problems in two-dimensional elasticity are given for domains (finite or infinite) bounded by a single closed contour. The method used (Cauchy's integral method) leads in the general case to Fredholm equations. By this same method the complete solution may be obtained for certain domains in a form that is simple and suitable for practical application.

Strength Testing of Aircraft Wings; a Review of Current Methods. W. W. Johnstone. *Australia, Council for Scientific and Industrial Research, Division of Aeronautics, Report No. SM. 52*, May, 1946. 74 pp., illus. 38 references.

This report reviews methods used in England, America, and Australia for applying test loads to aircraft wings. A detailed description is given of a mechanical method recently developed by the Australian C.S.I.R. in which it was attempted to standardize all the test equipment and at the same time to make it suitable for repeated load tests. The apparatus and methods used in making the tests are described, and further details about the hydraulic equipment and calibration methods are set forth in appendixes.

The Strength of Sheet-Stiffener Combinations in Compression. I—Flat Panels. N. B. Joyce. *Australia, Council for Scientific and Industrial Research, Div sion of Aeronautics, Report No. SM. 67*, April, 1946. 40 pp., figs. 24 references.

Methods of estimating the load-axial strain curve and point of ultimate failure of sheet-stiffener combinations under compression loads are reviewed. Each method examined was applied to the analysis of two such combinations for which complete test data information is available, one comprising a light panel with heavy stiffeners, the other a heavy panel with heavy stiffeners. For panels of the proportion examined it appears that the method suggested by E. F. Sechler and L. G. Dunn gives a good approximation to the load-strain relationship in the region of the buckling loads, but the method used in The Royal Aeronautical Society Data Sheets based on K. Marguerre's work is sufficiently accurate and easier to apply. In the region of the failing load the method of J. N. Goodier appears to give values for the stringer strain curve nearest to those obtained in tests.

Repeated Load Tests on a Mosquito Wing. W. W. Johnstone. *Australia, Council for Scientific and Industrial Research, Division of Aeronautics, Report No. SM. 59*, April, 1946. 15 pp., illus. 5 references.

The wing of a Mosquito airplane was tested to determine its behavior under repeated static loads. The design proof load of 75 per cent was applied about 3,500 times following the application of 1,150 smaller loads. The flexibility increased slightly during the early stages of the test, but there was no other deterioration that could definitely be attributed to the repeated loading. Accordingly the repeated loading was discontinued and the wing was then tested to destruction. The results were inconclusive but it appeared that the effect of repeated loading had no influence on the ultimate strength.

Temperature Measurements on a Beaufort Aircraft During Summer at Alice Springs and Melbourne. G. J. Dailey and F. A. Dale. *Australia, Council for Scientific and Industrial Research, Division of Aeronautics, Report No. SM. 65*, March, 1946. 25 pp., figs. 5 references.

To determine the maximum temperatures to which the structural parts of an airplane would be subjected in the tropical summer heat of sections of Australia, measurements were made of the temperatures of the wing structure, cockpit, and fuel tanks. Structure and fuel-tank temperatures were correlated with air temperature and solar radiation, and also with the wind speed. The maximum "parking" temperature level for metal airplane wings also was estimated. It was found that painted upper surfaces of metal wings under the given conditions reach 87 °C. five to ten times per year and in extreme cases more than 100 °C. may be recorded; clean, polished aluminum-alloy skins were 10 °C. cooler than painted skins; in climb, the wing structure cooled at the free-air lapse rate on a time basis, and after levelling out the temperature stabilized at 5 ° to 10 °C. above the ambient air temperature; the fuel temperature in the self-sealing tanks stabilized at the free-air temperature on the ground and was not perceptibly reduced after 40 min. of flight at 8,000 ft.

Bending and Buckling of Sandwich Type Beams. N. J. Hoff and S. E. Mautner. *Paper Presented at the Sixth International Congress for Applied Mechanics*, September 22–29, 1946. 41 pp., illus. 7 references.

From the essential parts of the strain energy stored in the faces and core and from the potential of the transverse and axial loads, the differential equations of bending of a sandwich-type beam were derived by means of the variational principle. Integration of these differential equations yielded simple formulas for the deflection of a cantilever and for the buckling load of a column. Beam and column tests carried out on 64 specimens gave results in reasonable agreement with the theory.

Cylindrical Buckling of Sandwich Plates. J. N. Goodier. *Journal of Applied Mechanics*, Vol. 13, No. 4, December, 1946, pp. A-253–A-260, figs. 5 references.

In the buckling of sandwich plates with a relatively easily deformed interior, or core, material, the core is not stiff enough to keep plane sections plane when the bending occurs. The core must then be analyzed according to the equations of plane strain, but the fact that the bending takes place in the presence of thrust means that terms representing the destabilizing tendency of the thrust must be included. The resulting problem is solved for a sandwich plate in "cylindrical buckling"—that is, in a mode analogous to that of the hinged column.

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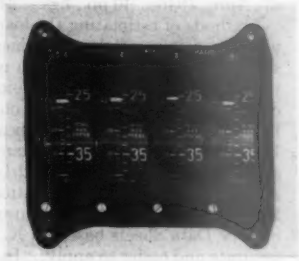

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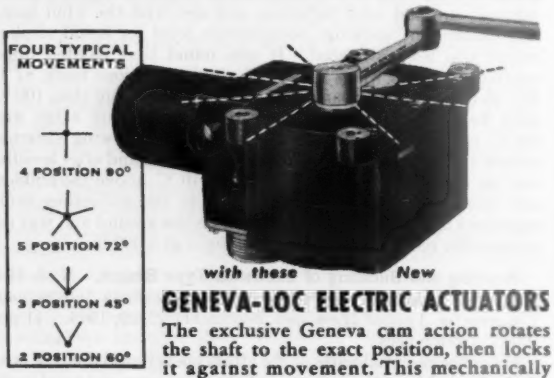

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The Buckling of a Square Panel Under Shear When One Pair of Opposite Edges is Clamped, and the Other Pair Is Simply Supported. D. M. A. Leggett. *Gt. Brit., Aeronautical Research Committee, Reports and Memoranda No. 1991*, June, 1941. 6 pp. 3 references. British Information Services, New York. $0.40.

Previous investigations of the behavior of a spar with thin sheet web have determined the shear load that will cause the web to buckle in cases where the edges of the plate are all clamped or all simply supported, but the case represented by the title of the present report had not been investigated. Such a case was studied and it was found that the value of the critical shear stress is almost midway between its values when all four edges are clamped and all four edges are simply supported. The method of solution developed is of general application, and can be used to investigate the stability of rectangular panels when the loading is any combination of shear and compression or tension, and the edges are clamped or simply supported, and not necessarily all clamped or all simply supported. By an easy extension the method of solution can also be used to find the periods of transverse vibration of rectangular panels for the same types of loading and edge fixing. The derivation of the equations used is explained in an appendix.

The Initial Buckling of Slightly Curved Panels Under Combined Shear and Compression. D. M. A. Leggett. *Gt. Brit., Aeronautical Research Committee, Reports and Memoranda No. 1972*, December, 1943. 15 pp., figs. 5 references. British Information Services, New York. $0.90.

This report extends to panels that are long and slightly curved the results reported in *R. & M. No. 1965* with regard to the initial buckling of flat rectangular panels under combined shear and compression. On aircraft with laminar-flow wing sections, it is desirable that the wing cover should remain smooth up to a factor of $1^1/_2$, and to achieve this a possible type of construction is one in which stringers are dispensed with and the cover is reinforced with closely spaced ribs and stiffeners. These divide the cover into a large number of long and slightly curved panels, and the results given in this report should be of value in estimating the combined shear and compression that such panels can carry without buckling and so developing waviness.

Compression Tests on Seven Panels of Monocoque Construction. H. L. Cox, F. R. Thurston, and E. P. Coleman. **Appendix.** H. E. Smith. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2042*, May 7, 1945. 21 pp., figs. 1 reference. British Information Services, New York. $1.75.

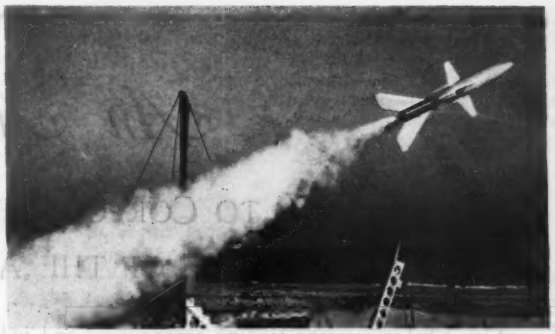
The primary purpose of the tests was to provide specific data for application to a particular design problem, but the opportunity was taken to develop a technique of testing by which comparison of experimental results with theoretic conclusions may be facilitated. All the panels tested were $20^1/_2$ in. wide by $12^1/_2$ in. long and the sheet cover was 0.08 in. thick; the panels were stiffened by stringers at 3.3-, 4-, or 5-in. spacing, the area of cross section of each stringer being about 0.05 in. The stringers were attached to the sheet cover by thread-cutting screws, screwed in the cover, and one of the principal objects of the tests was to determine the maximum permissible spacing of screws along the stringer consistent with a certain desired minimum load at failure. The behavior of the seven panels both before and after buckling of the plates between stringers was consistent with theory within the limits of accuracy expected, but the stresses at failure were neither consistent with existing theory nor even fully consistent among themselves.

General Stress-Strain Laws of Elasticity and Plasticity. A. Gleyzal. *Journal of Applied Mechanics*, Vol. 13, No. 4, December, 1946, pp. A-261–A-264, figs. 6 references.

A discussion of stress-strain laws that apply to problems where the material is elastic in some regions and plastic in others; for example, in a plastic-torsion problem or in a plastic-bending problem. These laws have experimental verification for metals in cases where strains are small, and stresses and strains are either monotonically increasing or monotonically decreasing at any one point.

The Theory of Curved Beams. G. C. Best. *Journal of Applied Mechanics*, Vol. 13, No. 4, December, 1946, pp. A-294–A-296, figs. 4 references.

The theory of curved beams is developed by a somewhat different procedure from that customarily employed. Deflections at the centroid are first assumed and then loads and stresses resulting from these deflections are estimated. This process works out in a somewhat more orderly fashion than the conventional development. Throughout, all measurements are to the centroidal axis rather than to the neutral axis. Final results are presented in such form that satisfactory accuracy may be obtained from slide-rule computations and approximate integration. Hence, the procedure is applicable to any section, it being unnecessary first to develop a special formula for each different section. An illustrative example is given. The theory is extended to cover the case of unsymmetric bending of curved beams. The effects of torsion, which will probably also occur in the generalized case, are not treated. These can be superimposed upon stresses due to bending.



The "Tiamat," a guided research missile developed by the N.A.C.A. **(See "N.A.C.A. Reveals Secret Guided Missile," page 47.)**

Note on the Shear Stresses in a Bent Cantilever Beam of Rectangular Cross Section. E. Reissner and G. B. Thomas. *Journal of Mathematics and Physics*, Vol. 25, No. 3, October, 1946, pp. 241–243. Calculations concerning the distribution of the stresses according to the Saint Venant theory.

Some Fundamental Theorems of Structural Mechanics in Vector Notation. R. J. Dunholter. *The Journal of Engineering Education*, Vol. 37, No. 3, November, 1946, pp. 207–209.

It is shown that the equation of virtual work, Maxwell's reciprocal law, and Castigliano's displacement theorem can all be presented for a complete structure consisting of bars subject to direct stress, bending, torsion, or shear, by using the vector notation.

Plates in Tension Joints Under Repeated Loading. H. W. Foster. *Product Engineering*, Vol. 17, No. 12, December, 1946, pp. 108–111, figs.

An investigation of the effect of the geometry of the joint, the stress-strain properties of the structural material, and the magnitude of the applied loading on the efficiency of plates in tension joints under repeated loading. The article is limited to a qualitative discussion of the variables present, with examples for particular types of joints and particular loading conditions. Graphs illustrate the net area and gross area efficiencies of typical joints under repeated loading.

The Effect of Fuselage and Nacelles on Wing Bending Moment, Shear and Torsion. H. V. Becker, H. B. Squire, and C. Callen. *Gt. Brit., Aeronautical Research Committee, Reports and Memoranda No. 2060*, November, 1943. 17 pp., figs. 1 reference. British Information Services, New York. $1.05.

The data obtained from recent wind-tunnel tests have been collected and presented in this report, together with a method for predicting the changes in aerodynamic loads due to the addition of fuselage and/or nacelles. These changes are small and the suggested method of estimation is adequate in most cases.

Stress Diffusion Problems. VI. W. J. Goodey. *Aircraft Engineering*, Vol. 18, No. 213, November, 1946, pp. 385–389, figs.

The diffusion of end load into a panel with $(2N-1)$ stringers is analyzed. The stringers are treated as distinct members separated by panels of skin which transmit only shear stress. The solution is based on the principle of minimum strain energy.

Orthogonal Functions Used in the Solution of Linear Difference Problems. S. U. Benscoter. *Journal of Applied Mechanics*, Vol. 13, No. 4, December, 1946, pp. A-281–A-283, figs.

A method of solution of linear difference equations is presented, in which the solution is assumed in terms of a finite set of orthogonal functions that satisfy the boundary conditions. A formula for the latent roots of the matrix of the system of equations is obtained. A simple formula is then derived for the reciprocal

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matrix in terms of the latent roots and latent vectors. A simple numerical example is worked out.

Electrical Computor Solves Wing Flutter Problems. *Aviation*, Vol. 45, No. 12, December, 1946, p. 111, illus.

The computer, developed by the Department of Electrical Engineering of Ohio State University, is based on the analogy existing between the equations of performance of the mechanical elements (mass, stiffness, and velocity damping) and the electrical elements (inductance, capacitance, and resistance). This computer also can be used to solve complicated vibratory problems of engine mounts and ailerons.

Little Shakers Test Big Structures. John Markus. *Scientific American*, Vol. 176, No. 1, January, 1947, pp. 6–10, illus.

Vibration effects in aircraft and other structures can be accurately tested by electromagnetic vibrators. With these units, forces of controlled amplitude and frequency are conveniently used on critical members. The method provides an effective means of determining beforehand whether the designers have properly allowed for the most severe conditions of vibration that might be encountered in actual use.

Impact Strength Increased by Removing Material. Lockheed Aircraft Corp., Structures Research Group. *Product Engineering*, Vol. 17, No. 12, December, 1946, pp. 131–133, illus. (Abstract.)

Photoelastic Stress Patterns Evaluate Stress Concentration. Wm. M. Murray. *Product Engineering*, Vol. 17, No. 12, December, 1946, pp. 134–136, figs.

The use of polarized light on models made of suitable transparent material affords a means of studying stress distributions and solving certain types of two-dimensional and three-dimensional stress problems.

Brittle Coating Method for Experimental Stress Analysis. Russell G. Anderson. *Product Engineering*, Vol. 17, No. 12, December, 1946, pp. 122–124, illus.

A description of the features, advantages, and applications of the Stresscoat method for the detection of strain and the evaluation of stress in critical regions of mechanical parts and assemblies. Experimental setups can be used in which service loadings are simulated by loads imposed by levers, hydraulic jacks, and similar devices.

Some Strength Tests of Stiffened Curved Sheets Loaded in Shear. Patrick T. Chiarito. *U.S., N.A.C.A., Restricted Bulletin L4D29 (Wartime Report No. L-259)*, April, 1944. 11 pp., illus. 3 references.

Charts for Critical Combinations of Longitudinal and Transverse Direct Stress for Flat Rectangular Plates. Charles Libove and Manuel Stein. *U.S., N.A.C.A., Advance Restricted Report No. L6A05 (Wartime Report No. L-224)*, March, 1946. 27 pp., figs. 7 references.

Charts for Calculation of the Critical Compressive Stress for Local Instability of Idealized Web- and T-Stiffened Panels. Rolla B. Boughan and George W. Baab. *U.S., N.A.C.A., Advance Restricted Report No. L4H29 (Wartime Report No. L-204)*, August, 1944. 14 pp., figs. 4 references.

Effect of Developed Width on Strength of Axially Loaded Curved Sheet Stringer Panels. Albert E. McPherson, Kenneth L. Fienup, and George Zibritosky. *U.S., N.A.C.A., Advance Restricted Report No. 4H08 (Wartime Report No. W-51)*, November, 1944. 21 pp., illus. 5 references.

Investigation of Methods of Supporting Single-Thickness Specimens in a Fixture for Determination of Compressive Stress-Strain Curves. Joseph N. Kotanchik, Walter Woods, and Robert A. Weinberger. *U.S., N.A.C.A., Restricted Bulletin No. L5E15 (Wartime Report No. L-189)*, May, 1945. 19 pp., illus. 2 references.

Comparison of Structural Efficiencies of Diagonal-Tension Webs and Truss Webs of 24S-T Aluminum Alloy. David W. Ochiltree. *U.S., N.A.C.A., Restricted Bulletin No. L5F25 (Wartime Report No. L-34)*, July, 1945. 8 pp., figs. 2 references.

Preliminary Investigation of the Relation of the Compressive Strength of Sheet-Stiffener Panels to the Diameter of Rivet Used for Attaching Stiffeners to Sheet. Norris F. Dow and William A. Hickman. *U.S., N.A.C.A., Restricted Bulletin No. L4I13 (Wartime Report No. L-61)*, November, 1944. 10 pp., illus. 4 references.

Effect of Variation in Diameter and Pitch of Rivets on Compressive Strength of Panels With Z-Section Stiffeners. I—Panels With Close Stiffener Spacing That Fail by Local Buckling. Norris F. Dow and William A. Hickman. *U.S., N.A.C.A., Restricted Bulletin No. L5G03 (Wartime Report No. L-44)*, August, 1945. 13 pp., illus. 2 references.

Determination of Desirable Lengths of Z- and Channel-Section Columns for Local-Instability Tests. George J. Heimerl and J. Albert Roy. *U.S., N.A.C.A., Restricted Bulletin No. L4H10 (Wartime Report No. L-180)*, October, 1944. 13 pp., figs. 3 references.

Wind Tunnels and Laboratories

The Use of Damping Screens for the Reduction of Wind-Tunnel Turbulence. Hugh L. Dryden and G. B. Schubauer. *Paper presented at I.A.S. 15th Annual Meeting*, New York, January 28–30, 1947. (For abstract see "I.A.S. Briefs" on page 24 of this issue, February, 1947.)

150,000 Horsepower Applied to Aeronautical Research. James A. White. *Electrical Engineering*, Vol. 65, No. 12, December, 1946, *Transactions*, pp. 833-839, illus.

A detailed description of the electrical equipment of the Ames Aeronautical Laboratory at Moffett Field, Calif., is given from the electrical engineer's point of view. This includes the electrical equipment utilized for operating wind tunnels designed for subsonic and supersonic air speeds. Information is given about the variable frequency systems used for operating propellers on models undergoing tests and about the power supply and distribution system of the laboratory.

Singing Corner Vanes: A Note on a Peculiar Double Resonant Sustained Oscillation Occurring in a Wind Tunnel. G. K. Batchelor and A. A. Townsend. *Australia, Council for Scientific and Industrial Research, Division of Aeronautics, Aerodynamics Note No. 62*, January, 1945. 11 pp., figs. 2 references.

Several audible, pure tones emanating from a wind tunnel were investigated. The sound radiation is shown to be produced by stationary sound waves in the double open-ended air spaces between the turning vanes at each of the four corners. The sound-wave formation is excited by the vortexes that are shed from the vanes by the airflow. The vortex shedding and the air-space vibrations resonate with elastic vibrations of the vanes, which in some cases are torsional and in others flexural.

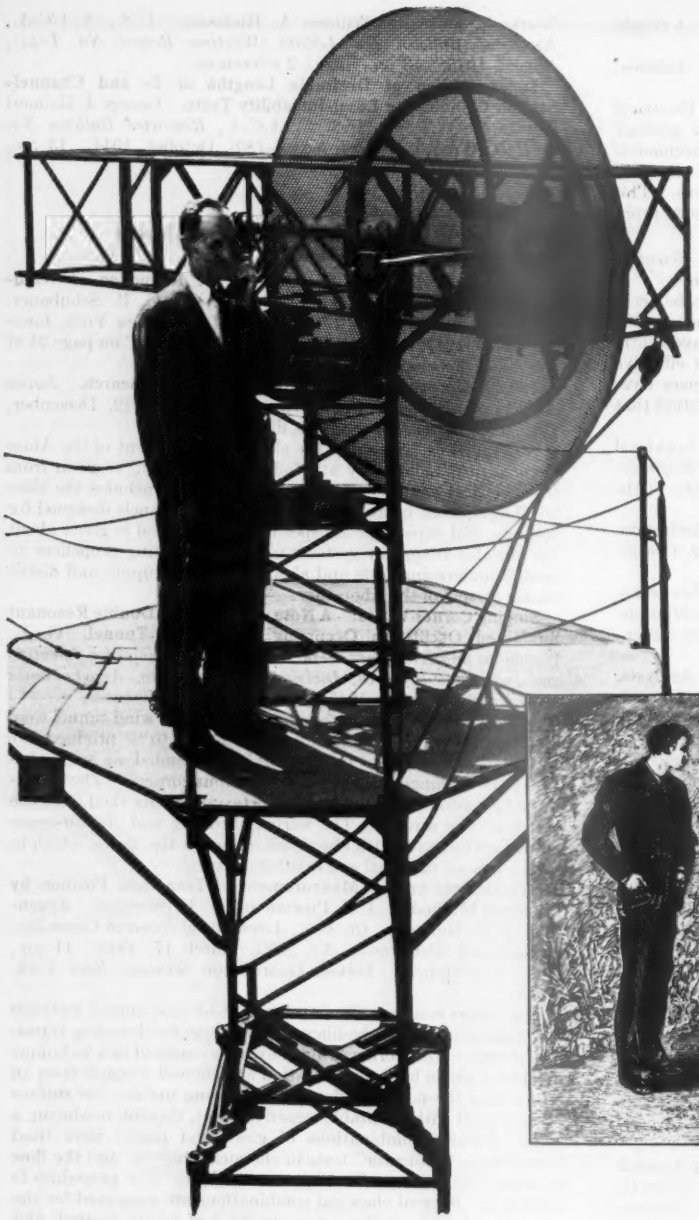
Experiments on the Measurement of Transition Position by Chemical Methods. J. H. Preston and N. E. Sweeting. **Appendix.** F. H. Burstall. *Gt. Brit., Aeronautical Research Committee, Reports and Memoranda No. 2014*, March 17, 1945. 11 pp., illus. 7 references. British Information Services, New York. $0.75.

The report concerns the development of wind-tunnel methods to supplement the smoke-filament technique for detecting transition points. The work was almost wholly confined to a technique in which a gas in high concentration was allowed to exude from an orifice near the nose and flow over the wing surface, the surface being coated with a suitable sensitive paint, thereby producing a stain. Various combinations of gases and paints were tried according to "indicator" tests in chemical analysis, and the flow of smoke from the orifice also was studied. The procedure is explained. Several chemical combinations are suggested for the gas and paint, depending upon the kind of record desired, and other methods under investigation are mentioned. It is indicated that the technique described should be applied to flow at high speeds and high Reynolds Numbers. It could be applied to pressure tunnels and to flight tests.

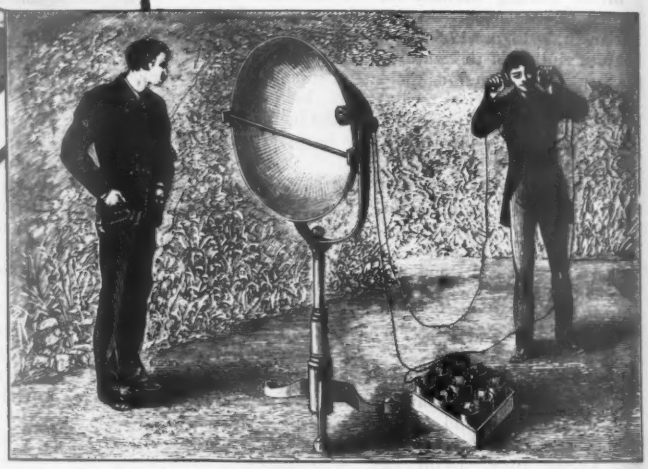
An Improved Smoke Generator for Use in the Visualisation of Airflow, Particularly Boundary Layer Flow at High Reynolds Numbers. J. H. Preston and N. E. Sweeting. *Gt. Brit., Aeronautical Research Council, Reports and Memoranda No. 2023*, October 19, 1943. 8 pp., illus. 1 reference. British Information Services, New York. $0.60.

Apparatus for producing an oil smoke to replace wood smoke for boundary-layer observations resulted in substantial improvement, especially with regard to density and freedom from deposits on the wing surfaces, which are likely to cause premature transition. The advantages of wood smoke are retained, since the oil smoke has no corrosive or irritant action; the apparatus is light, compact, easily constructed and quickly started. With good lighting, observations can be made at speeds up to 200 ft. per sec. The construction and operation of the smoke generator are explained in full.

(*Continued on page 85*)



Words that rode on a beam of light



If Alexander Graham Bell could look at the microwave antenna in the illustration, how quickly his mind would go back to his own experiments, 67 years ago!

For in 1880 the inventor of the telephone had another new idea. Speech could be carried by electric wires, as Bell had demonstrated to the world. Could it be carried also by a *light* beam?

He got together apparatus—a telephone transmitter, a parabolic reflector, a selenium cell connected to headphones—and "threw" a voice across several hundred yards by waves of visible light, electromagnetic waves of high frequency.

Bell's early experiment with the parabolic antenna and the use of light beams as carriers was for many years only a scientific novelty. His idea was far ahead of its time.

Sixty years later communication by means of a beam of radiation was achieved in a new form—beamed microwave radio. It was developed by Bell Telephone Laboratories for military communication and found important use in the European theater. In the Bell System it is giving service between places on the mainland and nearby islands and soon such beams will be put to work in the radio relay.

In retrospect, Bell's experiment illustrates once again the inquiring spirit of the Bell System.

BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

Books

All of the books reviewed and listed are in the I.A.S. Library and may be borrowed without charge, except for certain reference books. Application for loans should be made to The Paul Kollsman Lending Library, 2 East 64th Street, New York 21, N.Y.

Jane's All the World's Aircraft, 1945–46. 34th year of issue. Compiled and edited by Leonard Bridgman. New York, The Macmillan Company, 1946. 559 pp., illus. $19.

This is the American reprint of the British edition first published in February, 1946. As pointed out in the preface, the latest *Jane's* is essentially a war edition. Information on German and Japanese airplanes and engines and details of all new British aircraft released for publication up to the beginning of 1946 have been included, and there are sections on British and German gas turbines. The historical sections record events and the organization of military and civil aviation in all countries as they were during the last year of the war. International developments covered include the International Civil Aviation Conference at Chicago, the organization of the Provisional International Civil Aviation Organization, summaries of the organization of the International Air Traffic Association, and others. But the greater part of *Jane's* is always devoted to airplane descriptions and illustrations, and this section contains 339 pages. The descriptions are uniform and are accompanied by more than 700 illustrations, of which 550 are new. It is stated that this is the last issue of *Jane's* which will make use of blacked-in silhouettes. These will be of the open line type in the future. The engine section contains 94 pages. More specialized books, such as Paul H. Wilkinson's *Aircraft Engines of the World*, have to be used for completeness, but the great service done by *Jane's* is its inclusion of a large amount of material so organized, since its beginning in 1909, that it is indispensable for quick reference use and for survey purposes. This American reprint loses some of the clarity of the photographs in the original edition but can be recommended as a worthy addition to the series.

Carènes et Propulsion de la Galère a l'Hydravion (Hulls and Propulsion from the Galley to the Hydroplane). Robert Duhamel. Paris, Dunod, 1946. 590 pp., diagrs.

This is a detailed study on a technical level, intended for those engaged in research in naval construction, general aviation, and especially marine aviation. The first chapters give historical facts regarding different types of boats, shapes, and construction of hulls and familiarize the reader with marine terminology by means of a 30-page lexicon. Then the work takes up the theoretical and experimental problems of the field. The broad subject divisions are: general; hull forms and construction; theory of the boat and ship; hydroplanes and hydroairplanes; propulsion and the propeller. Under the heading "General Characteristics of Hulls" there are 60 full-page plans of different types, each showing longitudinal, horizontal, and vertical view. Details of construction, both wood and metal, are then given, including specifications, characteristics, and calculations for various parts and materials. This half of the book then concludes with the theory of floating bodies and discusses resistance, displacement, and the rudder. Although flying boat hulls and seaplane floats received comparatively generous treatment in all preceding sections, the second part of the book deals with them entirely. First, the development of the hydroairplane from the hydroplane is presented in detail, followed by discussion of the various means of power and the propeller. There are many diagrams and tables throughout the work, which lacks, however, an index or bibliography.

Aviation Insurance. D. Murray Stewart. New York, The Underwriting Printing and Publishing Co., 1946. 156 pp. $3.00.

In this book aviation insurance is divided into sections on hull, liability, accident, and air lines. Under each of these divisions there is parallel treatment of types of risks, policy forms, and underwriting. It is intended to meet the requirements of underwriters and field men and to be useful to those owning, operating, and financing aircraft. Some of the types of risks included are private pleasure, dealers and distributors, airmeets, and trip ticket policies. Among the details of policy forms described are schedule of statements, agreements, definitions, exclusions, conditions, warranties, and uncovered hazards. The sections on underwriting include such headings as facts disclosed, prototypes, underwriting, and rating. Miscellaneous aspects are included, bringing in some of the unusual situations connected with mercy flights, crop dusting, deliveries, gliders, dead storage, and advertising. Each chapter is followed by a group of questions. An index is included.

The World's Wings, What U. S. Air Policy for World Peace and Prosperity? Lucien Zacharoff. New York, Duell, Sloan and Pearce, 1946. 310 pp. $3.00.

The global airways network is described as the great economic prize of the recent war, comparable to the economic value of petroleum resources after World War I. The rapid technological development of air transport in the last two decades and of its importance as a factor in international affairs is outlined in the first chapter. The United States is held to be a pivot country in international affairs, and theories of our air policy, including monopoly, the chosen instrument, competition between air lines, and participation of surface carriers, are presented in the central chapters of the book. Testimony and debate given at Congressional hearings and other official sources furnish the data for these arguments. The international scene, including international conferences and organizations, and the plans of various nations to win airways control, are surveyed in the chapter on the new air world's foreign affairs. The author recommends international public control of air transport as the means most likely to preserve the peace and promote the fullest collaboration of nations for economic stability and international understanding.

Dials and Flight. Assen Jordanoff. New York, Harper & Bros., 1947. 359 pp., illus. $5.00.

Known for his ability to produce aeronautical books with clear text and illustrations, the author here presents an explanation of aeronautical instruments. The first 14 chapters deal with flight instruments; the next nine, with engine instruments; the next nine, with navigation instruments;

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Aetna Casualty & Surety Company
American Surety Company of New York
Hartford Accident & Indemnity Company
Massachusetts Bonding & Insurance Co.
New Amsterdam Casualty Company
Standard Accident Insurance Company
Standard Surety & Casualty Co. of N. Y.
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and the final three, with the Sperry air-driven, the suction gage, and the General Electric automatic pilots. Each instrument is dealt with systematically in a separate chapter, beginning with its purpose, location, description, and operation, and its use in flight and ending with instructions for maintenance. The instrument is described in detail, including tubing and mechanical or electrical linkages, as well as the instrument behind the dial. In the section on flight instruments is included a chapter on the portable instrument field test set.

The Aircraft Mechanic, a Manual for Certificate Candidates. Philip Siegel. New York, Pitman Publishing Corporation, 1946. 313 pp., illus. $4.00.

The material presented deals exclusively with aircraft, and the book is designed to help the aircraft mechanic obtain an aircraft mechanic certificate. Following a brief introduction stressing the use of *Civil Air Regulations* and *Civil Aeronautics Manuals*, propellers are discussed in the longest chapter in the book, followed by shorter chapters on aircraft hydraulics; aircraft rigging and assembly; aircraft wood, fabric, covering and finishing; and aircraft sheet metal, riveting, welding, and soldering. In each chapter, background information is given first, followed by questions and answers, usually of the multiple-choice type used on the examinations. A brief bibliography is appended to each chapter, referring to books, company publications, and appropriate publications of the Civil Aeronautics Administration. Definitions of terms are also given in each chapter.

Der Flugmotor; Bauteile und Baumuster (The Aviation Engine; Component Parts and Types). Hans Katz. Berlin, Walter de Gruyter & Co., 1943. 291 pp., illus.

The object of this instruction manual is stated to be that of presenting comparisons of the parts of the principal German aircraft engines. Following a brief introduction to the principles of the gasoline engine, such parts as carburetors, starters, cylinders, oil pumps, ignition, cooling system, and controls are described. There are usually details regarding the particular part as used in engines in general, including an explanation of its function and operation, followed by descriptions of the part as employed in the representative engines listed. The second section describes 16 engine models, including Bramo, BMV, Hirth, Argus, Junkers, and Daimler-Benz types. There is a picture of each, accompanied by various specifications such as dimensions, weight, valve timing, performance, etc. The book contains numerous excellent illustrations, most of which are photographs but also include exploded views, cutaways, and diagrams.

Gas Turbines and Jet Propulsion for Aircraft. G. Geoffrey Smith. 4th edition. New York, Aircraft Books, Inc., 1946. 246 pp., illus. $5.00.

Starting as a series of articles in *Flight* in 1941, the first edition of this book appeared in England in 1942. Three editions were published during the war, the last in early 1944. Much of the material was derived from patents, since current developments before the official announcement of British and American jet-propelled airplanes in January, 1944, were guarded for security reasons. This new edition is more than twice the size of the last one. New gas turbines and jet propulsion units are included with military and civil aircraft types developed in the last 3 years, and mention is made of various types that are under development and proposed. British and American designs and the principal German developments are described. Russian data are stated to be unavailable. Among the new chapter headings are metallurgy, testing and maintenance, and guided missiles and flying bombs. There is a separate chapter on aerodynamic problems, including boundary-layer control and compressibility effects. Ram-jets are mentioned briefly in the short chapter on guided missiles, and the material on the Leduc design and the German V-1 has been retained in this edition. Forewords are contributed by Gen. Carl Spaatz, Charles E. Wilson, and Sir Geoffrey de Havilland. Authors of recent technical papers have been liberally quoted,

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Chance Vought Aircraft is expanding its Engineering Department and needs Engineers to perform work on advanced aircraft of radical design.
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and the number of illustrations has been greatly increased. Data previously scattered have been gathered in this book, presenting a useful summary of the subject, and it should continue to be as useful as preceding editions have been.

Who's Who in British Aviation. 1946–47 edition. London, Temple Press Ltd., 1946. 338 pp. Paper cover.

This is the first postwar edition of this reference book. One-third of it consists of about 1,000 brief biographies of aeronautical personalities, principally British. Directories of service aviation, civil aviation, civil air stations, clubs, institutions and societies, and the aircraft industry make up the remaining two-thirds. There is no general index, but the arrangement is useful and the coverage is good, though limited to the British Empire. Directory information rather than detailed information is given on companies and other organizations. It is a useful directory, filling a definite need in aeronautical libraries for a recent work of this kind.

Other Books Received

AIR TRANSPORT

Air Transport Services, Agreement Between the United States of America and Norway Effected by Exchange of Notes signed at Washington, October 6, 1945; effective October 15, 1945. (Executive Agreement Series 482) Washington, Govt. Printing Office, 1946. 99 pp. $0.05.

Air-Cargo Potentials between Switzerland and Non-European Regions. U.S. Bureau of Foreign and Domestic Commerce. Washington, Govt. Printing Office, 1946. 28 pp. $0.05.

Army-Navy-CAA Standards for the Control of Instrument Flight Rule Traffic, Effective April 1, 1946. Washington, Govt. Printing Office, 1946. 35 pp., illus. $0.20. Topics covered are general; standards, including separation control, approach, phraseologies, emergency, procedures, flight information, service procedures and practices; procedures for alerting search and rescue facilities.

Digest of Airways Operations Service. Vol. 1. Operation of: Aeronautical Communications Stations; Airport Traffic Control Towers; Airway Traffic Control Centers. Washington, Civil Aeronautics Administration, Office of Federal Airways, August, 1946. 92 pp., maps, diagrs.

How Free Are the Skyways? American Historical Association. Washington, Govt. Printing Office, 1945. 41 pp. $0.15. A War Department "GI Round Table" pamphlet providing information as a basis for discussion on freedom of the air, obstacles to freedom, and postwar flying.

AIRPORTS

Pilots' Flight Manual; a Handbook of Charts for Instrument Approaches, Let-downs, and Airport Details: Eastern United States. Washington, Aeronautical Services, Inc., 1946. Loose-leaf. Pocket-size manual with weekly revision service intended for use by itinerant pilots and nonscheduled operators. Each sheet bears an approach chart, ceiling and visibility minimums, and aircraft and airport restrictions.

Sail Tests for Military Construction. George E. Bertram. Chicago, American Road Builders' Association, 1946. (Technical Bulletin No. 107.) 92 pp., illus. The equipment and test procedures for determining the engineering properties of sails encountered on highways and airport locations. Exceptionally well illustrated throughout; indexed.

Steps an Airport Sponsor Must Take to Participate in the Federal-aid Airport Program. W. R. Macatee, Washington, American Road Builders' Association, 1946. (Bulletin No. 114.) 30 pp. This article is followed by a reproduction of the Civil Aeronautics Administration's proposed Rules and Regulations for carrying out the program.

ATOMIC POWER

Applied Atomic Power. Edward S. C. Smith, A. H. Fox, R. Tom Sawyer, H. R. Austin. New York, Prentice-Hall, Inc., 1946. 227 pp., illus. $4.00. The purpose of this book is to explain in relatively simple language just what atomic power is and how it may be applied practically. Sections on the nature of uranium, atom-splitting, and the history of the development leading to the atomic bomb are followed by a section on possible methods of converting atomic energy into mechanical power. This includes a description of a closed-cycle 35,000 gas-turbine plant and a brief discussion of possible applications of atomic power to aircraft rockets, locomotives, and ships. The book closes with a chapter on industrial benefits from U-235 research and appendixes on the work on the atomic bomb, a conversion table for energy units, and a table of nuclear and atomic masses of isotopes. The book is a compilation of published information, but the material is gathered in convenient form and is put in clear language.

BUSINESS AND FINANCE

Air Market Values. 1947 Spring edition. Los Angeles, George Stromme & Associates, 1946. 128 pp. $15 per year, including quarterly revisions. Current wholesale, retail, and loan values are given for more than 1,400 models of airplanes manufactured in the United States since 1930. Military aircraft that have been offered to the public as surplus and postwar aircraft in production and proposed are included in separate sections. A list of approved-type certificates from 1926 to date, samples of finance and insurance forms, reference data on down payments and maximum credit permissible, and a formula for evaluating specific airplane prices are also included.

The Airplane Manufacturing Industry. Post War Prospects for Eighteen Companies. New York, Hornblower and Weeks, 1946. 40 pp. An investment research study giving, for each company, wartime production, present activities, and future plans.

Bibliography of Aviation Studies. Aviation Committee, American Marketing Association. Philadelphia, The Curtis Publishing Co., 1946. 17 pp. About 150 studies are listed relating to the economic and marketing aspects of aviation from 1929 to date. Passenger studies, air-cargo and mail studies, and surveys of the aircraft market are included.

EDUCATION

Aviation Education Material, prepared by The Massachusetts Aviation Education Committee. Boston, 1946. 61 pp. Outlines of the teaching of aviation in elementary and secondary schools, with a bibliography of books and printed materials and films.

How to Build Terrain Models. U.S. Navy. Office of Research and Inventions. Washington, Govt. Printing Office, 1946. 28 pp., illus. $0.10. Manual for schools. One of the practical applications of the subject is stated to be air transportation studies.

Industrial Education Bibliography. A List of Texts and Other Books for Use in Developing an Effective Training Program. Chicago, National Metal Trades Association, 1946. 22 pp. Reproduced from typewritten copy. A selected list arranged by subject, covering all levels of training in shop practice, management, drafting, etc.

A Survey of Collegiate Courses in Aviation and Related Fields. American Council on Education. Revised edition. Washington, 1946. 64 pp. Under the name of each institution are included lists of the courses it offers.

ELECTRICAL EQUIPMENT

Accumulator Charging; Maintenance and Repair. N. S. Ibbetson. 9th edition. London, Sir Isaac Pitman & Sons, 1946. 172 pp., illus. $2.25. "Many small alterations and additions" have been made to this work, which had three editions during the war.

ENGINES

Wir Wiederholen Flugmotorenbau; 1400 Fragen und Antworten aus Flugmotorenkunde, Werkstoffkunde, Arbeitskunde und Fachrechnen. (Aircraft Engine Construction Reviewed; 1400 Questions and Answers on Aircraft Engines, Materials, Production, and Shop Mathematics.) Alfred Sproul. Vienna, Dipl.-Ing. Bohmann, Verlag für Fachliteratur, 1943. 175 pp., illus.

FIRE CONTROL

"Automatic" Hydraulic Data. Clyde M. Wood. Youngstown, Ohio, "Automatic" Sprinkler Corp. of America, 1944. 263 pp., illus. Results of hydraulic research and tests, methods of hydraulic calculation and design, and other compilations, covering principles of hydraulics, fittings and valves, volume and pressure, and sprinklers. The principal application is to the airplane hangar, which is the subject of almost all the examples

Fire and the Air War. Horatio Bond, Editor. Boston, National Fire Protection Association, 1946. 262 pp., illus. $4.00. A compilation of articles by specialists in the field on damage, protection, and casualties caused by incendiaries in England and Germany and on the atomic bomb as used against Japan. Illustrations show results of bombings and various aspects of fire prevention. A brief bibliography is included.

GLIDING

Segelflug (Gliding.) Willy Eichenburger and Harold Widner. Aarau, H. R. Sauerländer & Co., 1946. 127 pp., illus. Sw. Fr. 6.20. A clear and practical treatment of aerodynamics, design and construction of gliders, and instruction in the fundamentals and in advanced practice such as towing and soaring. Complicated mathematics is omitted, and the entertaining style is supplemented by interesting and sometimes humorous drawings.

HISTORY

A Chronicle of the Automotive Industry in America. Cleveland, Eaton Manufacturing Co., 1946. 82 pp., illus. The text is accompanied by pictures of various models for each year. There are plates showing military vehicles, trucks, 1946 passenger models, and nameplates.

Evalução da Aeronáutica no Brasil (Evolution of Aeronautics in Brazil). Vol. 1. Jose Garcia de Sausa. Rio de Janeiro, Grafica Auvidor S.A., 1945. 567 pp., illus. First of five projected volumes. The greater part of this volume is a 290-page annotated bibliography of works on aeronautics in several languages. This is followed by a pictorial record of the lives and work of Alberto Santos-Dumont, Bartholomeu de Gusmão, and others, which contains many reproductions of source material such as letters, posters, books, periodical articles, certificates, etc. There is an index of names.

INSTRUMENTS

Optique Instrumentale (Optics of Instruments.) G. A. Bautry. Paris, Masson et Cie., 1946. 539 pp., diagrs. 1100 fr. The author is director of the Laboratoire d'Essais and intends this work to be primarily one of instruction in optics for the analysis of instruments and their structure. It is hoped it will be of some value to

physicians, as well as to instrument makers. The subjects included are stigmatism, optical systems, lenses, symmetry, vision, formation of images, and application in optical instruments.

JUVENILE

The Test Flight of Sky Robin. Doris Garn. Pictures by George Zaffo. Cleveland, World Publishing Co., 1946. 22 pp., illus. $1.00. A story for children of incidents of a plane's first flight, illustrated partly with movable cutouts.

LIBRARIES

Procedures Manual of the Boeing Airplane Company Library. (Report No. WD-12632). Wichita, Kan., Boeing Airplane Co., October 29, 1945. 77 pp., diagrs. Covers organization, administration, order and cataloging procedures, and lending and reference services. Forms used in all procedures are included.

MATERIALS

Aircraft Metals. Standards and Curriculum Division, Training, Bureau of Naval Personnel. Washington, Govt. Printing Office, 1945. 160 pp., illus. $0.30. Introductory textbook for enlisted men covering ferrous and nonferrous metals, heat-treating, working processes, protection for metals, and physical testing.

Alcoa Aluminum in Automatic Screw Machines. Pittsburgh, Aluminum Company of America, 1946. 95 pp., illus. A booklet designed to supply some of the basic information on machining aluminum alloys on automatic screw machines; intended for the experienced man.

Butalastic Polymers, Their Preparation and Applications; a Treatise on Synthetic Rubbers. Frederick Marchionna. New York, Reinhold Publishing Corp., 1946. 642 pp., diagrs. $8.50. An authoritative and exhaustive work, with numerous literature references and indexes of authors, catalysts of polymerization, and subjects.

Corrosion of Metals. American Society for Metals. Cleveland, 1946. 181 pp., illus. $3.00. Five lectures at the twenty-seventh National Metal Congress and Exposition, February, 1946. Contents: C. W. Borgmann, Basic Principles of Metallic Corrosion; C. P. Larrabee, Effect of Composition and Environment on Corrosion of Iron and Steel; W. O. Binder, Corrosion Resistance of Stainless Steels and High Nickel Alloys; H. L. Burghoff, Copper and Copper Alloys in Corrosive Environments; E. H. Dix, Corrosion of Light Metals (Aluminum and Magnesium).

Helium. W. H. Keesom. Amsterdam, Elsevier, 1942. 494 pp., diagrs. $10. The data known so far on helium are collected into a comprehensive summary, with numerous literature references and subject and author indexes.

Magnesium Fabrication. L. B. Harkins. New York, Pitman Publishing Corporation, 1947. 149 pp., illus. $2.75. Intended for the student and the man on the job rather than for the engineer and the industrial manager, this book presents data for all phases of the fabrication of sheet, extrusions, and tubing from magnesium alloys. The worker inexperienced with sheet-metal work may use the book with a standard work on that subject. Foundry technology is not included. A well-planned, clearly written, illustrated manual.

Mechanical Packings Manual. A Handbook on Leather and Synthetic Rubber Packings. Worcester, Mass., Graton and Knight Co., 1945. 321 pp., illus. $4.50. Basic principles of design, application, and maintenance for engineers and students, including origin and principles of hydraulic and pneumatic machines, materials used in packings, causes of corrosion of machine parts adjacent to packings, and oil seals. The work is freely illustrated with photographs and diagrams, and the numerous tables are also listed separately. A glossary, a bibliography, and a compilation of related technical data are included.

Petroleum Production. Vol. II. The Optimum Rate of Production. Park J. Jones. New York, Reinhold Publishing Corp., 1946. 293 pp., diagrs. $4.50. A technical economic study of the optimum rate of production in relation to oil, condensate and natural gas reserves, well-producing capacity for reservoirs, uniform rates of production and depletion, and other factors.

Rarer Metals. Jack de Ment and H. C. Dake. Brooklyn, Chemical Publishing Co., 1946. 332 pp. $7.50. Basic data are presented on 20 of the less-familiar elements, excluding the metals of the rare earths. The history, mineralogy, physical and chemical properties, compounds, recovery from the ore, preparation, technology, and analysis of each metal are given. While completeness is not claimed, the authors have made a useful compilation, including numerous literature references.

The Technology of Magnesium and Its Alloys. Adolph Beck. London, F. A. Hughes & Co. Limited, Abbey House, N.W.1, 1943. 512 pp., illus. 30s. A reprint of a translation first published in 1940; the original work was compiled at I. G. Farbenindustrie A.-G. Subjects covered are mechanical and physical properties, design, machining, chemical analysis and metallurgy. A general index and a name index are included.

MATHEMATICS

Applied Mathematics for Engineers and Physicists. Louis A. Pipes. New York, McGraw-Hill Book Co., 1946. 618 pp., diagrs. $5.50. Based on a course in applied mathematics given by the author during the last 5 years at the Graduate School of Engineering of Harvard University, this text is intended to illustrate the use of mathematical analysis in the solution of technical problems. Topics of higher mathematics which form the essential mathematical equipment of a scientific engineer or a physicist are presented, including the fields of electrical, mechanical, and civil engineering and classical physics. Bibliographies are given at the ends of chapters.

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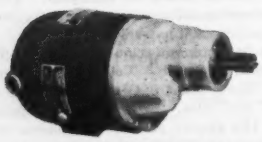

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Basic Mathematics for Technical Courses. Clarence E. Tuites. New York, Prentice-Hall, Inc., 1946. 474 pp., diagrs., tables. $5.00. Designed for technical institutes and the junior college field, this textbook was developed in courses of instruction at the Rochester Institute of Technology. The problems are selected from a variety of fields of application, and many are presented in the form of mechanical drawing. An appendix of 131 pages of tables is included. The scope of the book includes the slide rule, arithmetic, algebra, graphical representation, and logarithms in the first part and trigonometry in the second.

Descriptive Geometry. Earle F. Watts and John T. Rule. New York, Prentice-Hall, Inc., 1946. 301 pp., diagrs. The authors believe that a substantial percentage of engineering problems can be solved preferably by the graphical method. The material in this book is presented with the aim of developing ability in the student to choose the simplest of the possible solutions to a given problem, and therefore various possibilities of attack on the basic group of problems underlying the subject are given. Appendix material on precision drawing and the properties of plane figures is included. The authors are on the faculty of the Massachusetts Institute of Technology.

Métrologie Générale (Grandeurs et Unités) [General Metrology (Sizes and Units)]. Maurice Denis-Papin and Jacques Vallot. Paris, Dunod, 1946. 428 pp., diagrs. A handbook of units of measurement, symbols, equations, formulas, conversion tables, etc., for use in science and technology. There is explanatory text under each topic, and all details are well indexed.

Relaxation Methods in Theoretical Physics. R. V. Southwell. Oxford, Clarendon Press, 1946. 248 pp., diagrs. $7.00. A continuation of the author's *Relaxation Methods in Engineering Science.* The present work applies the methods to problems governed by partial differential equations involving two space variables. Relaxation methods are discussed as applied to plane-potential problems, the problem and conformal transformation, "quasi-plane-potential" problems, and those involving boundaries or interfaces not initially known.

MEDICINE

The Biology of Flight. Frederick L. Fitzpatrick and Karl A. Stiles. London, George Allen and Unwin Ltd. 162 pp., illus. 8*s.* 6*d.* British edition of a book that appeared in 1942 in the United States in the "Air-Education Series."

Doctors at War. Edited by Morris Fishbein. New York, E. P. Dutton & Co., 1945. 418 pp., illus. $5.00. The story of medicine in wartime is told by 15 of the top executive medical men in the armed and Government services.

Medicina Aeronautica. Tomo I. El Vuelo de Alta Cota (Aviation Medicine. Vol. I. High-Altitude Flight.) L. Pescador. Barcelona, Editorial Cientifico Medica, 1941. 206 pp., illus. The first volume covering one part of what is pointed out as a special application of medical science. Beginning with a historical survey and a review of characteristics of the atmosphere, the work then goes into the general concepts and technique of investigation in the medical aspects of high-altitude flight. In the last-named section, as well as in many other places in the book, reference is made to work at the Low Pressure Chamber of the Institute of Aeronautical Medicine of Berlin. The greater part of the volume covers in detail the various parts of the human organism affected by high-altitude flight and the phenomena involved. There are such topics as respiration, cardiovascular apparatus, organs of sense, the kidneys, digestion, and muscular activity. In these discussions there are numerous charts, diagrams, and references to the work and experiments of specialists, with numbered references to a 600-item bibliography. The work concludes with the clinical and therapeutic aspects of acute and chronic altitude sickness and the effects of rays, electricity, and temperature. There is an index, as well as the bibliography of works in many languages.

Spraying of DDT From Aircraft. U.S. War Department. Washington, Govt. Printing Office, 1946. 25 pp., illus. $0.10. Principles and technical aspects including both equipment and use.

METEOROLOGY

Maps and Elementary Meteorology for Airmen. W. Myerscough. 2nd edition. London, Sir Isaac Pitman & Sons, Ltd., 1944. 74 pp. 4*s.* 6*d.* A revised edition with material added to the meteorological section. Intended to be of assistance to a student prior to taking official courses.

The Meteorological Conditions in the Upper Reaches of the Radiosonde Flights over the United States. Oliver R. Wulf, Mary W. Hodge, and Stanley I. Ohloy. Chicago, University of Chicago Press, 1946. (Dept. of Meteorology of the University of Chicago, Miscellaneous Reports Nos. 20 and 21). 2 Vols. $1.00 each. Vol. 1: Pressures, Pressure changes, and Types of Pressure Patterns. Vol. 2: Diurnal Effects in Temperature and Pressure.

Pyrheliometers and Pyrheliometric Measurements. I. F. Hand. Washington, U.S. Weather Bureau, 1946. 55 pp. Types of measurements of solar radiation, instruments, calculations, and tables.

Recueil de Données Statistiques Relatives a la Climatologie de la France (Compilation of Statistical Data on the Climatology of France). J. Sanson. Paris, L'Office National Meteorologique. 1945. 148 pp. (Ministère des Travaux Publics, Memorial de la Meteorologie Nationale, No. 30.) Part one consists of normal values, such as mean temperatures, rainfall days of sunshine, etc., for varying periods, such as 1891–1930, 1926–1935, 1840–1935. Part two gives statistical information on abnormal phenomena for more recent periods. The O.N.M. is part of the Air Ministry and its work is partly for aviators.

MILITARY AND NAVAL AVIATION

Annual Register of the United States Naval Academy, Annapolis, Md. One Hundredth Anniversary Edition, June 7, 1945. Washington, Govt. Printing Office, 1945. 146 pp. $0.25.

The Identification of British and Enemy War Planes. 10th edition. Liverpool, Real Photographs Co. 23 pp., illus. 1*s.* 6*d.*

Index to Army Regulations Including All Regulations and Changes Promulgated Prior to 1 January, 1946. U.S. War Department, Adjutant General. Washington, Govt. Printing Office, 1946. 430 pp. $0.60.

Ships of the Royal Navy with Forces of British Dominions Overseas. Francis E. McMurtrie. London, Sampson Low, Marston and Co. Ltd., 1945. 272 pp., illus. 8*s.* 6*d.* Descriptive text and pictures on opposite pages. Numerous aircraft carriers have been added since the 1942 edition.

Study of Pacific Bases. U.S. House of Representatives, Committee on Naval Affairs, Subcommittee on Pacific Bases. Washington, Govt. Printing Office, 1945. 138 pp. $0.25. Following a general survey, there is listed under each island: history, people, products, and physical characteristics; potential postwar use (strategic and economic); cost of capture (or recapture); and investment. Possible future use of certain islands as military or civil aviation bases is briefly considered in some cases.

PRODUCTION

Aviation Supply. Standards and Curriculum Division, Training, Bureau of Naval Personnel. Washington, Govt. Printing Office, 1945. 149 pp., illus. $0.30. A textbook for enlisted men, describing progressive movement of supplies, determination of allowances, replenishing, use of forms, storeroom layout, and problems of aviation storekeepers.

Principles of Tool Engineering. Raymond R. Bloom. New York, McGraw-Hill Book Co., 1946. 234 pp., diagrs. $2.40. Written to furnish students in tool engineering with a background in interchangeable manufacturing, the material in this text has been tested in the author's classes at The Pennsylvania State College over a period of 15 years.

U. S. Military Acceptances, 1940–1945. Aircraft, Engine and Propeller Production. Washington, U.S. Civil Aeronautics Administration, Office of Aviation Information, Division of Aviation Statistics, 1946. 204 pp., diagrs. This report includes those civil transport planes of twelve-place or more produced in the years 1940–1945. Experimental production, engines for use in tanks, airships, balloons, Link trainers, guided missiles, and certain aerial targets are not included. Employment data for the industry and by plant are reported. Following a statistical summary, all data are reported by individual plant by the month, figures being presented separately for each model.

SOCIETIES

The Engineering Institute of Canada: Charter, By-laws and Code of Ethics. Montreal, 1946. 27 pp.

International Civil Aviation; Interim Agreement Between the United States of America and Other Powers.... (Executive Agreement Series 469). Washington, Govt. Printing Office, 1946. 21 pp. $0.05. Text of the agreement creating the Provisional International Civil Aviation Organization.

Provisional International Civil Aviation Organization. Handbook. 9th edition. Montreal, 1946. 50 pp. A directory of the officers, delegates, and committees.

STRESS ANALYSIS

Proc[illegible]ings of the Society for Experimental Stress Analysis. Vol. 4, No. 1. Cambridge, Mass., Addison-Wesley Press, Inc., 1946. 129 pp., diagrs. $5.00. *Contents:* A Graphical Method of Rosette Analysis, by K. J. Bossart and G. A. Brewer; A Nomographic Solution to the Strain Rosette Equations, by T. A. Hewson; A Nomographic Rosette Computer, by N. Grossman; Photoelastic Analysis of a Spar Bulkhead in a Semi-Monocoque Airplane Fuselage, by H. Becker; Stress Study of a Fabricated Steam Chest, by A. W. Brunot and W. G. Schmittner; New Portable Stress Analysis Equipment, by C. M. Hathaway; Measurement of Residual Stresses in Torsion Bar Springs, by H. O. Fuchs and R. L. Mattson; Residual Stress Indications in Brittle Lacquer, by C. W. Gadd; Mechanical Strain Gage Technique of Separating Strains due to Normal Forces and Bending Moments, by A. U. Huggenberger; Impact on Prismatical Bars, by T. Davidson and J. H. Meier; Pressure of Plastic Concrete in Forms, by C. Macklin; The Stress Gage, by R. E. Kern.

WORLD WAR II

Bombardier. Stephen Gilbert. London, Faber and Faber, Ltd., 1945. 263 pp. 8*s.* 6*d.* A novel of the British Army in France in 1940. The hero is in an Irish Searchlight Regiment.

The Effects of the Atomic Bombs on Hiroshima and Nagasaki. (U.S. Strategic Bombing Survey.) Washington, Govt. Printing Office, 1946. 77 pp., illus., maps. The atomic bomb attacks and damage, general effects, how the atomic bomb works, and recommendations for defense of the future in case of war.

The Epic of Tarawa. W. Richardson. London, Adhams Press Limited. 96 pp., illus. 3*s.* 9*d.* Written in London by a writer in the U.S. armed forces at the request of the publishers. Aviation plays some part in the action. The foreword is by Adm. Harold R. Stark.

The Epic of the 101st Airborne. A pictorial biography of the United States 101st Airborne Division, compiled and arranged by the Unit Public Relations Office, Auxerre, France, 1945. Washington, *Infantry Journal,* 1946. 144 pp., illus. A record in photographs and words of what the Screaming Eagle Division accomplished in battle and saw in Europe.

Services of the Libraries of the Institute of the Aeronautical Sciences

The services of the Libraries are available to all members of the Institute, to Corporate Members, to advertisers in the AERONAUTICAL ENGINEERING REVIEW and AERONAUTICAL ENGINEERING CATALOG, and, under usual library limitations, to the public. Four specialized services are available.

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This reference library contains over 12,000 aeronautical books, magazines, pamphlets, and reports gathered from world-wide sources and is one of the most complete aeronautical libraries in the world. Material from this library is not available for loan but may be used for reference purposes.

The Pacific Aeronautical Library

6715 Hollywood Boulevard
Los Angeles 28, California

Established in cooperation with the aircraft companies the library serves. The leading aircraft companies in or near Los Angeles participate in its support and operation.

This service library for aeronautical research is available to the public for reading privileges. Source material includes aerodynamic and structural research reports, as well as books on drafting, production methods, history, and allied sciences. It furnishes books, periodicals, and pamphlet material to the participating aircraft companies to supplement their engineering libraries.

Technical Information Service

This service has experienced personnel under the supervision of trained aeronautical engineers to compile any information desired. The services range from listing specialized reference books to the preparation of exhaustive bibliographies, digesting of reports, and general surveys of any aeronautical subject. Some of the available services are:

Bibliographies on any aeronautical subject.
Reports on any aeronautical subject.
Digests of aeronautical books, papers, periodicals, and references.
Translations.
Engineering investigations of special aeronautical subjects.
Biographies of individuals engaged in aeronautics.
Photostats of any aeronautical or general engineering material.
Microfilms made on special order.
Photographs made from the Institute's photographic collection.
Drawings and tracings made.

In addition to the services mentioned any commission which comes within the scope of the Service will be accepted. Special arrangements may be made for work requiring several weeks or months.

Translators are available for accurate transcriptions of all foreign language data. Translations are carefully edited by trained engineers.

Reproductions of any material in the collections of the Institute may be ordered at standard photostat rates.

INSTITUTE OF THE AERONAUTICAL SCIENCES, INC.

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Personnel Opportunities

This section is for the use of individual members of the Institute seeking new connections and organizations offering employment to aeronautical specialists. Any member or organization may have requirements listed without charge by writing to the Secretary of the Institute.

WANTED

Aircraft Equipment and Accessory Engineer—Excellent opportunity for graduate A.E., M.E. or E.E. with at least 4 year' practical experience as application engineer on electromechanical actuators; electric motors, and automatic control for aircraft. Reply to Lear, Incorporated, 110 Ionia Ave., N.W., Grand Rapids 2, Mich.

Electronic Engineer-Pilot—A position is open for a highly qualified electronic engineer who is also an expert multiengined pilot The work will consist primarily of flight research and test of aeronautical automatic controls of many descriptions. The engineer will be involved from the inception of an idea or device, through its development stages, in the planning and flying of the tests, to the final demonstration and sales stages. It is desirable that the applicant be skilled in instrument and airways procedures or is a former air-line, N.A.T.S., or A.T.C. pilot. Apply by letter, giving engineering and flight experience and starting salary expected, to Chief Flight Test Engineer, Minneapolis-Honeywell Regulator Company, 2753 Fourth Ave. S., Minneapolis.

Engineers—Young engineering graduates with up to 3 years' experience required for test activity and aerodynamic or thermodynamic analysis on extensive and continuing development programs on nonrotating aircraft power plants. Mechanical or aeronautical engineers preferred. Address reply to Continental Aviation and Engineering Corporation, Detroit 14.

Aerodynamicists—College graduates with sound theoretical training and at least 1 year of graduate study in compressible subsonic flow and supersonic flow to do research and test work in the Supersonic Wind Tunnel of the Ballistic Research Laboratories, Aberdeen Proving Ground, Md. This is one of the few operating supersonic wind tunnels in the country having a test section larger than 1 sq.ft. Remuneration in accordance with qualifications. Write, giving education and experience, to The Commanding General, Aberdeen Proving Ground, Md., Attention: Director, Ballistic Research Laboratories.

Aerodynamicists, Flight Test Engineers, Mechanical Engineers, Electronics Engineers, Physicist-Mathematician, Administrative Engineer—Competent to assume additional responsibility in an expanding engineering organisation as staff and project engineers on new, diversified, challenging work in the development of complex aviation devices. Only those applicants possessing initiative and ability to think analytically are desired. Plant is located approximately 200 miles west of New York City. Wages paid are equal to, or above, locality average. For further details write to: Personnel Manager, Link Aviation Devices, Inc., Binghamton, N.Y.

Structural Designers—Experienced in sheet-metal aircraft structures for new helicopter design. Graduate engineers from recognized universities preferred. Plant located in suburb of West Philadelphia. All replies will be held confidential. Write Personnel Department, Piasecki Helicopter Corporation, Sharon Hill, Pa.

Layout Draftsmen—Five or more years' experience on aircraft layout and design. Rotary wing preferred. Graduate engineers from recognized universities preferred. Plant located in suburb of West Philadelphia. All replies will be held confidential. Write Personnel Department, Piasecki Helicopter Corporation, Sharon Hill, Pa.

Aerodynamicist and Vibration Specialist—Experienced in rotary wing field. Graduate engineers from recognized universities preferred. Plant located in suburb of West Philadelphia. All replies will be held confidential. Write Personnel Department, Piasecki Helicopter Corporation, Sharon Hill, Pa.

Translators—Part-time, N.Y. residents, to abstract and translate foreign language articles on aviation. Must be thoroughly familiar with aviation terms of at least one language. Submit language experience, background, etc., to Accurate Translation Service, 711 Woodward Building, Washington 5, D.C.

Assistant Designer—Wanted immediately by Canadian branch of leading aircraft hydraulics and landing-gear specialists. Must be capable of taking full responsibility for undercarriage design projects, and should have had some experience in design of hydraulic pumps, systems, and electro-hydraulic units. Knowledge of stress analysis and familiarity with both British and American engineering practices also desirable. This is a permanent position with good prospects. Starting salary $275 to $300 per month, depending on qualifications. Apply in writing to Chief Engineer, Dowty Equipment (Canada) Limited, 999 Aqueduct St., Montreal 3, Canada.

Senior Draftsman—Wanted immediately by Canadian branch of leading aircraft hydraulics and landing-gear specialists. Must have minimum of 3 years' experience in the more mechanical side of aircraft design work and, preferably, 1 year's design experience on undercarriage and hydraulics, variable-pitch propellers, fuel systems, or other similar accessories. Should be capable of detailing any undercarriage or hydraulic layout and of carrying out elementary stress analysis. Familiarity with both British and American engineering practices also desirable. This is a permanent position with attractive prospects. Starting salary proportional to qualifications offered. Apply in writing to Chief Engineer, Dowty Equipment (Canada) Limited, 999 Aqueduct St., Montreal 3, Canada.

Assistant or Associate Professor—To teach courses in aerodynamics and wind-tunnel and airplane design. Must have graduate work in aerodynamics. Prefer man with teaching and practical experience. Salary and position will depend upon qualifications. Applicants should submit detailed record of education and experience. Address reply to Aeronautical Engineering Department, University of Kansas, Lawrence, Kan.

Aerodynamicists and Aeronautical Engineers—Positions available for highly qualified technical personnel with good theoretical or experimental background to engage in development and test work in stability, control, high-speed, and supersonic aerodynamics. Projects include new designs of piloted and pilotless aircraft, new wind tunnels and associated equipment, and advanced testing techniques. Salary in accordance with qualifications and Civil Service regulations. In reply please give brief summary of personal qualifications, education and experience. Address: Director, David Taylor Model Basin, Washington 7, D.C.

Layout Draftsmen—College graduates preferred, with aeronautical or mechanical engineering degrees. Must have 3 to 5 years' experience in aircraft industry as layout draftsmen working on structures, stress analysis, and design. Plant located just outside Washington, D.C. Address inquiries to Engineering and Research Corporation, Riverdale, Md.

Engineers and Physicists—The Cleveland Laboratory of the National Advisory Committee for Aeronautics has openings for engineers and physicists to work in fundamental research applicable to aircraft propulsive systems. Research is in progress on engine performance, fuels, thermodynamics, compressors, turbines, and materials. Applications of the principles of fluid mechanics are being investigated in the speed ranges covered by subsonic, transonic, and supersonic flow rates. There are openings for professional men ranging from a starting rate of $2,644.80 per annum for men just out of college to $8,179.50 per annum for men with qualifying experience in their respective fields. Apply to National Advisory Committee for Aeronautics, Cleveland Airport, Cleveland, Ohio; Attention, Mr. John D. Tousignant.

Chief Aerodynamicist—Services of highly qualified aerodynamicist required to act as Chief Aerodynamicist. Applicants must be graduate engineers from recognised universities. Experience on personal aircraft desirable. Applicants should write, giving complete details of education, experience, and salary expected, as well as availability, to Fleet Manufacturing and Aircraft Limited, Fort Erie, Ontario, Canada.

Assistant or Associate Professor—An assistant or associate research professor with strong theoretical background wanted to engage in research in the field of stability and missiles. Advanced degrees preferred. Salary commensurate with training and experience. Apply by letter giving details of educational background, experience, salary expected, availability, and personal history, to D. W. Dutton, Director, Daniel Guggenheim School of Aeronautics, Georgia School of Technology, Atlanta, Ga.

Professor of Aeronautical Engineering—To teach advanced courses in aircraft design, materials and processes, and structures. Opportunity for research work in newly organized Navy Ordnance program provides for full year-round employment. Rank and salary dependent on educational background and experience. Considerable experience in aircraft industry and a permanent interest in teaching are desirable. Address: Dr. M. J. Thompson, Chairman, Department of Aeronautical Engineering, The University of Texas, Austin 12, Tex.

Aerodynamicists—One or two positions open for experimental and theoretical research in supersonic aerodynamics in Navy Ordnance development program. Preference given to applicants with experience in supersonic field but will consider those with good background of fundamentals and subsonic work who wish to acquire experience in supersonics. Salary dependent on education and experience. Address: Dr. M. J. Thompson, Associate Director, Defense Research Laboratory, The University of Texas, Austin 12, Tex.

Physicist or Research Engineer—To do basic research and development work in applied optics related to supersonic airflow visualization. Work includes application of spark and schlieren photography and interferometry to supersonic wind tunnel test program. Salary dependent on education and experience. Address: Dr. M. J. Thompson, Associate Director, Defense Research Laboratory, The University of Texas, Austin 12, Tex.

Electronics Engineers, Project Engineer—The U.S. Naval Air Station, Quonset Point, R.I., has vacancies for highly qualified and experienced electronics engineers P-5, at $5,905.20 per annum; P-6, at $7,102.20 per annum; and a project engineer, P-3, at $4,149.60 per annum. Applications (Civil Service Form 57) are desired from persons who feel that they are capable of performing at the above-mentioned professional level, and should be mailed to the Recorder, Board of U.S. Civil Service Examiners, U.S. Naval Air Station, Quonset Point, R.I.

Mechanical Engineers, Designers and Layout Draftsmen—Having a minimum of 3 years' industrial experience on small electromechanical devices. Positions are in the Engineering Division of the makers of the Link Trainer. Engineering degrees or equivalent are required for engineering and designing positions. Forty-hour week allows leisure to enjoy area's many outdoor activities. Wages paid are equal to, or above, locality average. Send all particulars to Personnel Manager, Link Aviation Devices, Binghamton, N.Y.

Aeronautical Engineers—The Board of U.S. Civil Service Examiners, U.S. Naval Air Station, Quonset Point, R.I., announces that a limited number of applications are now being accepted for the position of Aeronautical Engineer (Power Plants), P-3, $4,149.60 per year. Applicants must show that they have successfully completed a full 4-year course leading to a Bachelors' Degree in Aeronautical Engineering in a college or university of recognized standing; or 4 years of successful progressive aeronautical engineering experience. In addition, applicants must show 3 years of progressive professional aeronautical engineering experience involving aircraft power plants. Graduate study in aeronautical engineering involving aircraft power plants successfully completed in a college or university of recognized standing may be substituted for experience year for year, up to a maximum of 3 years. Applicants applying for this position should mail Standard Civil Service Form 57 to: Recorder, Board of U.S. Civil Service Examiners, U.S. Naval Air Station, Quonset Point, R.I.

Research Engineer—Responsible position open with small corporation engaged in development engineering on aircraft instrumentation and control systems. Background of mechanical engineering or applied physics required. Address inquiries to Box 388, Richmond, Va.

Thermodynamicist—With strong theoretical background to engage in research work in the field of jet propulsion. Advanced degrees preferred. Replies will be held in strict confidence. Write Cornell Aeronautical Laboratory, Employment Office, Buffalo 5, N.Y.

672. Professor or Associate Professor—Aeronautics department of engineering school desires services of professor capable of teaching undergraduate and graduate courses in aircraft propulsion. Must have good academic training and teaching experience. Will have supervision of entire aircraft power-plant course program. Fully permanent position. Detailed description desired of education, teaching, and industrial experience. Salary and rank dependent upon qualifications.

671. Instructor or Assistant Professor—Sought by Aeronautical Engineering Department of Southwestern university. Should have master's degree and be able to teach in fields of aerodynamics and fluid mechanics, structures, and power plants and be capable of specializing in one of these.

670. Research and Aerodynamics Engineers—Long-term helicopter development program for Army Air Forces requires additional experienced and capable engineers. Exceptional working conditions and opportunities. Work involves aerodynamics, vibration, and flutter analyses on advanced designs. Substantial experience in aerodynamics or vibration work essential. East Coast company.

651. Aeronautical Administrative Engineer—Experienced in handling Navy Contract procedures and in designing for production. All replies will be held confidential. East Coast company.

The number preceding the notices represents the Box Number of the Institute of the Aeronautical Sciences to which inquiries should be addressed.

643. Professor of Aeronautical Engineering—To take charge of this work in a well-established department where specialization is largely in aircraft propulsion and aerodynamics. Large graduate enrollment, good industrial contacts, and opportunities for consulting and research work. Salary attractive.

634. Chief Engineer—Leading aircraft accessory firm making mechanical devices for aircraft. Located in a desirable Midwest city. Excellent opportunity for the proper man. Should be experienced in machine design, electrical design, small mechanisms, and possibly small rotating machinery. Must be experienced in handling people, supervising design, making engineering decisions for production, and supervising large number of projects. Please send complete information in first letter on entire background, including salary requirements and recent salaries. Our employees know of this opening and therefore applicants will not be embarrassed by writing to their own employer.

629. Assistant Professor—To conduct classes in airplane detail design and stress analysis in large engineering college. Must have aeronautical engineering degree and industrial experience. Advanced degree preferred but not essential. Immediate appointment. In replying, please submit brief record of education and experience.

627. Aeronautical Engineer—Civil Service position open immediately in Washington, D.C., for aircraft engineer with several years of progressive experience in structural design. Good opportunity for permanent appointment for engineer having proper qualifications. Duties involve responsibility for accurate investigations of special design problems and authoritative review and evaluation of major structural design features of new military aircraft to ensure compliance with Navy requirements and good engineering practice. Salary $5,905 per year. In applying give brief sketch of personal qualifications, education, and experience.

626. Propeller Project Engineer—Immediate permanent opening for project engineer with design experience in controllable-pitch propellers from 65 to 200 hp. Good testing facilities available and excellent opportunity for advancement with established Mid-West manufacturer. Reply stating full particulars of past experience, salary required, and other useful information.

616. Associate or Full Professor—A leading Midwestern university which is developing an extensive graduate instruction and research program in the fields of high velocity aerodynamics and jet propulsion needs an additional permanent staff member. Teaching will consist of one-third to one-half of load, balance on research. Rank will be Associate or Full Professor. Salary attractive; advanced degree required plus practical experience.

608. Patent Engineer or Attorney—Position requires at least 5 years' industrial experience in the preparation of patent applications covering electromechanical and electronic mechanisms such as control systems, servomechanisms, industrial instruments, automatic pilots for aircraft or gyro instruments. Electrical Engineering or Physics degree combined with degree in Patent Law preferred but not mandatory. Position requires ability to assume full charge of a small Patent Department, persistent follow-up of engineers to obtain patentable ideas.

607. Design Engineer—Position requires at least 5 years' industrial experience in the layout anddesign of electromechanical mechanisms such as controls, industrial instruments, aircraft instruments, automatic pilots, or gyro instruments. Engineering degree preferred but not mandatory. Position requires ability to assume responsibility for the mechanical design in connection with one or more projects and close cooperation with the Project Engineer.

606. Senior Project Engineer—Position requires at least 5 years' industrial experience in the basic development and design of electromechanical and electronic mechanisms such as control system, servomechanisms, industrial instruments, automatic pilots for aircraft, or gyro instruments. Electrical Engineering or Physics degree preferred but not mandatory. Position requires ability to direct several assistants in the handling of one or more major projects.

605. Senior Designers—Wanted by aircraft-engine manufacturer. Will make major design layouts of engine and component parts. Must be able to make all necessary design computations. Should have several years' experience with internal combustion engines. Location Midwest.

604. Senior Layout Men—Wanted by aircraft-engine manufacturer. Must have extensive experience with internal-combustion engines. To make complicated layouts from specifications, drawings, sketches, or notes furnished by engineers or designers. Should have considerable knowledge of manufacturing processes. Location Midwest.

598. Aeronautical Engineers—Immediate positions open in Washington, D.C., for aircraft engineers with practical experience in preliminary investigations of new aircraft designs and airplane performance. Salary between $4,149 and $4,902 per year. In applying please give brief sketch of personal qualifications, education, and experience.

597. Aeronautical Engineers—Immediate positions open in Washington, D.C., for aircraft engineers with practical experience in structural design and research. Salary between $3,397 and $5,905 per year. In applying please give brief sketch of personal qualifications, education, and experience.

595. Modelmakers—Craftsmen skilled in the use of hand and power tools to close tolerances wanted for model work by growing industry in the West. Experience in making wind-tunnel, free flight, and tow basin models for Army, Navy, N.A.C.A., or industry desirable. Position permanent. Please state full particulars in first letter, including age, experience, references, and salary desired.

593. Resident Sales Engineers—Near New York, Boston, Bangor, Albany, Scranton, Philadelphia, Richmond, Roanoke, Columbia, Jacksonville, Birmingham, Nashville, Cincinnati, Pittsburgh, Buffalo, Detroit, Chicago, St. Louis, Little Rock, New Orleans, San Antonio, Dallas, Oklahoma City, Kansas City, Omaha, Minneapolis, Helena, Casper, Denver, Albuquerque, Phoenix, Salt Lake City, Carson City, Boise, Seattle, Portland, San Francisco and San Diego. If you live within a reasonable distance from these cities and are willing to represent a new young firm of consultants in them and surrounding communities on a straight commission basis, kindly submit your complete background and present status.

586. Project Engineer—To handle a complete helicopter development program. Should have not less than a Bachelor's degree in engineering and at least 5 years of rotary wing experience. In replying, applicants should submit complete background information and a recent photograph.

584. Chief Project Engineer and Several Project Engineers—For design and development work in various forms of jet propulsion. Prefer men having some experience with rockets, ramjets, pulse-jets or turbojets. Experience in performance analysis desirable. Eastern location. Reply by letter stating details of education, experience, personal data, and salary desired.

583. Aerodynamicist—For design and development of diffusers, nozzles, compressors, etc., in connection with jet propulsion development

program. Prefer man familiar with transonic and supersonic airflow. Eastern location. Reply by letter stating details of education, experience, personal data, and salary desired.

582. **Thermodynamicist**—Preferably with internal combustion experience for development work in connection with various forms of jet propulsion systems, including cycle analysis, combustion chamber design, etc. Familiarity with rocket and jet fuels desirable. Eastern location. Reply by letter stating details of education, experience, personal data, and salary desired.

581. **Aeronautical Engineer**—With airplane stability and control experience wanted by electronics company engaged in guided-missiles development. Location in vicinity of Boston. Good opportunity for right man.

568. **Personnel**—An expanding southern New England helicopter company has positions available in several fields for personnel interested in rotary wing aircraft. Experience in helicopters is desired but not necessary Give full education and experience.

490. **Assistant or Associate Professor**—Sought by Aeronautics Department of Engineering College to teach undergraduate and graduate courses in aerodynamics, aircraft structures, or aircraft propulsion. Must have good academic training and teaching experience; constructive interest in aeronautical research and development, preferably industrial or laboratory experience in this field. Starting salary range: $4,000 to $6,000 depending upon qualifications.

AVAILABLE

674. **Aeronautical Engineer**—Aerodynamicist, B.Ae.E., age 22, single. Has over 2 years' experience in wind tunnel work, air loads, performance, stability, and control. Will receive M.Ae.E. during present school year. Good background in theoretical aerodynamics, stress analysis, and jet propulsion. Interested in teaching. Must remain in New York City vicinity until July 1. Available immediately.

673. **Teacher**—Graduate of the Massachusetts Institute of Technology in aeronautical engineering desires a teaching or administrative position with a foreign or domestic college or university. Qualified to teach aerodynamics, airplane design, wind-tunnel techniques, modern flight-testing methods, air-transport problems, and related fundamental subjects. Holds C.A.A. single- and multiengined commercial pilot's license, with instrument and instructor ratings. Prefers position with opportunity for combining academic work with flight testing, flight demonstration, and for flight instruction. Has had administrative, practical, and teaching experience in the aviation field. Will gladly furnish complete credentials, with references, upon request.

669. **Aerodynamics Engineer**—Chief aerodynamics engineer with prominent aircraft company. Advanced degree in mathematics and physics. Publications in dynamics and thermodynamics. Experience in aircraft heating and deicing. Desires position in metropolitan area with progressive concern or recognized university.

668. **Administrative or Executive Engineer**—Twenty years' well-rounded experience in all phases of organization, systematizing, design, engineering, production, and helicopter. Has experience in the automotive, aircraft-engine, and aircraft industries. Formerly experimental engineer, assistant engineer, factory manager, and general manager. Will definitely consider position in other than aircraft industry.

667. **Aeronautical Engineer**—B.S. Degree in Mechanical and Aeronautical Engineering. Taking graduate studies majoring in aeronautics. Two years' experience in drafting and aerodynamics in the aircraft industry, doing layout, major detailing, casting and forging drawing. Interested in aerodynamics or stress-analysis positions. Will accept mechanical or aeronautical engineering position in the Far East, especially in the Philippines.

666. **Sales and Service Engineer**—B.Ae., N.Y.U., 1941; married, age 28. Four and one-half years' A.A.F. Engineering Officer (Major). Varied technical and administrative assignments in connection with modification, overhaul, and repair of all types of aircraft and associated equipment. One year own manufacturing business. Few months air line. Completing training for Commercial Pilot Certificate. Particularly interested in sales and service or employment with overhaul and/or modification agency.

665. **Training Supervisor**—Twelve years of practical aeronautical and teaching experience, ranging from instructor to training supervisor at a U.S. Naval aircraft shore establishment. Background includes the training fields of private trade school, public school, air line, and Government plants. Capable of planning, administering, coordinating, teaching, and testing school, shop, and supervisory improvement courses. Experience has covered mechanical training on the job, apprenticeship training, supervisory improvement training and testing, and veterans' training.

664. **Aeronautical Engineer**—B.Ae.E., age 29, married, veteran of World War II. Four years as a Naval Aviator. Two thousand hours' flight experience in single- and multiengined land and sea aircraft. Possesses valid commercial pilot's license. Experience as a project engineer, design draftsman, and stress analyst. Working knowledge of all phases of aviation. Desires position as a flight test engineer. Will consider positions anywhere in the continental limits of the United States.

663. **Engineer**—Heating, ventilating, and exhaust systems engineer; B.S. in Ae.E. Age 29, married. Four and one-half years' experience in the design, maintenance, and overhaul of aircraft exhaust, heating, and ventilating systems. Completely familiar with all types of aircraft and ground heaters, heat exchangers, anti-icing and deicing systems and ventilating systems. Experienced in problems relating to aircraft-engine exhaust systems, such as collector rings, short stacks, flame dampeners, silencers, and carburetor heater shrouds. Has a working knowledge of turbosupercharger and induction systems. Exceptional executive and supervisory experience. Desires position as sales or field service engineer. Other engineering positions will be considered.

662. **Production or Factory Management**—B.S.E. (Aero. Eng.); top quarter, Big Ten University class. Six months' prewar experience in production control with leading parts manufacturer. Three years as A.A.F. engineering officer in charge of aircraft overhaul subdepot, supervising 350 civilian employees, machine shop, sheet metal, welding, woodmill, etc. One year postwar as aircraft structures engineer. Desires responsible position in production or factory management with progressive-minded manufacturer of mechanical products. Keenly interested in production control, production planning, and factory management and will consider opportunities in any related position. Mid-West preferred.

661. **Research Engineer**—Age 29. B.S. in M.E., University of Pennsylvania, 1940. Experienced analyst in thermodynamics, heat transfer, general fluid mechanics, and aerodynamics. Present employer well satisfied, but applicant wants nonmilitary research work. Six and one-half years with large aircraft manufacturer, past year and one-half on supersonic studies, including setting up Schlieren optical system and developing method of analysis for flow of compressible fluids.

660. **Engineer-Pilot**—M.E.; several years' experience many military and commercial types, land, sea, and helicopter; commercial and instrument ratings; 4 years' test and research with reputable organizations. Good knowledge of operational problems; well acquainted with current electronics equipment and its limitations. Desires change. Interested in pilot-engineering-administrative position with concern having well-backed program.

659. **Aeronautical Engineer**—B.S.A.E., age 30. Eight years' aircraft engineering, design, and fabrication experience including 2 years of stress analysis and testing; 2 years of production engineering and liaison work; 4 years as design group leader on surfaces, controls, and power plant installation; assistant project engineer. Present position design engineer, general. Familiar with Army, Navy, and C.A.A. requirements. Some experience on guided missiles. Presently taking evening graduate work in mathematics and engineering. Interested in design work. Available on 30 days notice. Location open.

658. **Administrative-Executive-Field Service**—Desires to join group with sound research and modest production program. Twenty-one years' experience in the industry in almost every phase; now staff member in responsible position with large engine firm. Holds commercial pilot's license with instrument and instructor ratings, single- and multiengined, A and E license. Prefers to affiliate with group that can use several thousand hours' flying experience plus sales and executive ability.

657. **Layout Draftsman**—Five years' experience in aircraft industry. Three years' experience on fuselage and electrical installation. Desires responsible layout position with aircraft manufacturer. Will locate anywhere.

656. **Management Executive**—B.S. in M.E. Over 20 years' experience in aviation, including engineering, production, quality control, materials, contracts, labor problems, costs, contract termination, and property disposal. Five years' research, N.A.C.A., hydrodynamics, and aerodynamics. One year on flight performance data analysis. A and E mechanic, private pilot. During war represented the Bureau of Aeronautics in plants of major aircraft manufacturers, heading staffs up to 160 engineering, clerical, and shop personnel. Long experience in dealing with Government agencies. Desires responsible position with an organization needing a versatile, well-informed executive.

655. **Engineer or Executive**—Twenty-four years' experience in tool, production, and design engineering; 8 years in aircraft. Positions filled include project engineer, chief tool designer, chief production engineer, and chief engineer. Thoroughly capable of handling either design, production, or tooling and methods. Willing to accept lesser position if opportunity for advancement is evident.

654. **Administrator-Engineer**—Twenty years in aviation engine and airplane manufacturing, including 3 years as project officer on transport aircraft design in Bureau of Aeronautics. Experience includes positions in engineering, financial, and administrative divisions. Capable, versatile, dependable. Desires connection as military liaison, manufacturer's representative, or executive assistant in New York area.

653. **Aeronautical Engineer**—Age 25, married. B.S. in Ae.E.; 2 years' experience as stress analyst in large aircraft plant. At present, graduate student at M.I.T. completing studies toward S.M. in Ae.E. in June. Desires work about July 1 in flutter or high-speed aerodynamics.

652. **Aeronautical Engineer and Aircraft Maintenance Engineer**—B.S. in Ae.E. Age 28, married. Five years' experience with A.A.F. as Aircraft Maintenance Officer with rank of Major. Maintenance experience on single-engined, twin-engined, and four-engined aircraft. Diversified experience in personnel management. Desires supervisory position wherein a high degree of responsibility must be held. Now holding responsible engineering position with leading air line.

649. **Aeronautical Management or Administration**—28 years old, married. B.S. in Mechanical Engineering from Purdue in 1940, with major in industrial engineering and aeronautical engineering courses. Four years' experience with large aircraft-engine manufacturer as an engineering trainee and as a field service representative and 2 years as a power-plant engineer for a transcontinental air line. Desires permanent position in management or administration of an

aeronautical concern with an opportunity for advancement.

648. Field or Sales Engineer—Five years' experience in foreign and domestic field in installation and sales engineering for major aircraft instrument company. Experience includes work with latest-type gyros and automatic flight control and automatic approach control equipment. Three years' contact with aircraft concerns in Southern California. Desires position on West Coast.

647. Design Engineer—Degree of B.S. in Ae.E., with 2 years' experience in aerodynamics and detail design relating to advanced aircraft with a large West Coast company. Desires position with a future involving research and design. Also possesses ability in design illustration. Any location considered.

646. Administrative—Desires responsible administrative connection, and will consider investment, in new or expanding aviation enterprise. Has extensive knowledge and resourcefulness resulting from training in aviation specialties, business administration, and manufacturing, plus active association with aviation during past 10 years and prior experience in business organization, office management, accounting, manufacturing, and sales. Capable of handling personnel and developing a well-rounded organization.

645. Associate Professor of Aeronautical Engineering—Doctor of Aeronautical Engineering in a large Mid-Western university would like to change his position for a similar one. At the present time gives structural courses. Possesses experience in wind-tunnel operation and a thorough knowledge of aerodynamics.

644. Foreign Sales Engineer—Internationally known aeronautical engineer and editor, 10 years of foreign experience, linguist, desires position as foreign sales manager, sales engineer, or European contact man for American aircraft or aircraft equipment manufacturer. Willing to locate in Europe. Has influential Governmental, commercial, and private contacts in various countries. Top references available. Age 40, personable, executive type.

641. Aeronautical Engineer—B.Ae.E., Rensselaer Polytechnic Institute, 1939. Age 31, married. Private pilot. Eight years' design and field engineering work including administrative and supervisory experience for major aircraft accessory manufacturer. Ground and flight test experience, both Army and postwar commercial planes. One year project engineer and market analyst for development of light-plane products. Well-established West and East Coast aircraft contacts. Desires administrative or sales engineering position in aircraft or allied industry. Prefers East or West Coast. No objection to traveling. Available immediately.

639. Stress Analyst—Ten years' varied experience as stress analyst. In charge of complete stress and static test data for several small companies. Chief of Structures for a well-known personal plane manufacturer. Experienced in all-wood, steel tubular, and all-metal aircraft. Desires position relating to structures and utilizing the maximum of experience. Midwest or Eastern location preferred.

638. Aeronautical Engineer—B.S. in M.E., 1934, New York University (Guggenheim School of Aeronautics). Eight years' general aircraft engineering experience, including positions as Project Engineer, Chief Aerodynamicist, and Acting Chief Engineer on Naval aircraft, helicopters, and amphibians. Available for responsible position immediately.

637. Mechanical and Aeronautical Engineer—B.S. in M.E., Aeronautical Engineering option, 1936. Will receive M.S. degree in M.E. during present school year. Two years' experience machine tool design. Three and one-half years' experience in aircraft propeller design and vibration research. Almost 1 year's experience in aircraft automatic landing electronic equipment research. Thirty-nine months' service in Army Air Forces Air Matériel Command's Engineering Division Laboratories as Project Officer with considerable supervisory responsibilities. Highest references. Desires position in engineering liaison, sales, or development in aircraft or mechanical equipment manufacturing.

636. Mechanical Engineer—Age 28. Interested in engineering sales. Three years' experience in steel industry as specification writer, field engineer, and maintenance foreman. Three years' experience in the aircraft industry as design layout draftsman and flight-test engineer. Employed at present by research and development engineering concern working on aircraft gas turbines.

635. Sales Engineer—Graduate aeronautical engineer with 4 years' experience in design of aircraft and hydraulic equipment; holder of private pilot certificate. Desires position as a Sales Engineer (not necessarily in aircraft). Single. Free to travel. Location open.

633. Executive Assistant and Industrial Engineer—Age 38, single; 13 years' engineering experience including cost analysis, planning and scheduling production, sales forecasting, budgetary control, etc., as well as airport management. Can assist on product development and production of plastic structures and/or prefabricated houses. Also qualified to handle business relations with Government agencies. Separating from A.A.F. after 2 years overseas and 3 years' procurement and development engineering.

632. Aeronautical Engineer-Export—B.Ae.E., Rensselaer Polytechnic Institute. Ex-Naval Officer with 1 year's liaison engineering experience on high-speed research; 1 year's electronics training in the Navy; 1 year's practical work in aircraft production; 3 months' experience as buyer for export, plus publicity work. Graduate of European high school; has done atomic physics graduate work. Desires participation in export or establishment in an engineering product manufacturing company or airways in Southern Europe, South America, New York, or Los Angeles area.

631. Test Pilot—Graduate aeronautical engineer. Over 4,000 hours' single- and multiengined ratings. Instrument and instructor ratings. Radio license. Three years' test pilot for Navy. Experienced in making engineering reports. Prefers test flying work with engineering work anywhere in the United States.

630. Aeronautical Engineer—Graduate. Seventeen years' well-rounded experience with several leading aircraft manufacturers and U.S. Navy. Jet-propelled and supersonic pilotless aircraft. Design supervisory, organizational, and executive background, all phases. Previous salary in $9,000 range.

628. Professor of Aeronautical Engineering—Bachelor's Degree in Physics; graduate work in mathematics. Author of engineering textbook in aerodynamics. Four years' teaching experience in aeronautical engineering department at Southern engineering school. Experience in teaching senior work in aerodynamics, airplane layout and design, and aerodynamic laboratory with instructional wind-tunnel work. At present in charge of all aeronautical courses and development of aeronautical laboratory in leading engineering university. Desires permanent professorship in aeronautical engineering department where aeronautical graduate work is available.

625. Industrial and Aeronautical Engineer—B.S. in Mechanical and Electrical Engineering; 2 years' postgraduate Aeronautical Engineering. Twenty-one years' naval aviator; wide experience operating, maintenance and overhaul various types aircraft and engines. Retired as a Commander, U. S. Navy. Four years' shop superintendent in factory manufacturing aircraft and aircraft engines. Five years' quality manager for one of the largest aircraft manufacturers. Desires position as quality manager or manufacturing executive.

623. Manufacturers' Technical Sales Representative—Aeronautical design engineer experienced in technical sales representation desires connection with manufacturer or distributor of aviation products in selling to East Coast aircraft manufacturers. Ten years' experience in the aircraft industry includes positions as technical sales representative, design engineer, and project engineer. Salary or commissions. Holds pilot certificate and will travel in company owned or privately owned aircraft.

621. Aeronautical Engineer—B. of Ae.E., New York University. Three years' experience in aircraft stress analysis, including aerodynamic loading, salvage, and design. Some light-plane flying experience. Holds Marine Engineer's license obtained in service. Desires responsible position doing aeronautical or mechanical engineering work. New York City or adjacent area preferred. Available immediately.

620. Executive—French resident in U.S.A. since 1940. Varied experience in aeronautical, automotive, and mechanical engineering. Research minded, many ideas for future development. Has occupied high responsible administrative official positions. Recently, Consulting Engineer in charge of a complete helicopter project covered by his own patents. Desires position in which engineering background, administrative training, and knowledge of French and European countries would be of value.

619. Public Relations Specialist—B.S. in Commercial Aviation; Journalism minor. Ten years' experience aviation publicity and editorial work. Aggressive and tenacious with influential world contacts. Pilot, radio operator, and mechanic with working knowledge of engineering, manufacturing, distribution, and transport. Desires career position with aviation firm or agency aviation account. Location immaterial. Résumé on request.

618. Meteorologist-Engineer—Graduate meteorologist and engineer; B.S. Meteorology, New York University; B.S.M.E., Case School of Applied Science. Age 28. Served as commissioned meteorologist with A.A.F. in U.S. Served as operations and dispatch officer with A.T.C. overseas for 14 months. Three and one-half years in service. Position wanted with air line or other concern interested in air transportation. Interested primarily in flight operations or traffic promotion work. Holder F.C.C. radio permit and C.A.A. Tower Controller's Certificate. Will consider work in domestic or foreign fields.

615. Aeronautical Engineer—Age 27, B.A., Columbia University, 1939; B.S. in Aeronautical Engineering from M.I.T. in 1942; M.S. from M.I.T. in 1945 as result of course in servomechanisms and instrumentation sponsored by Army Air Forces. Associated for 4½ years with Army Air Forces Air Matériel Command, Engineering Division, as aerodynamicist concerned with aircraft stability and control problems, including direction of flight tests, instrumentation, analysis of wind-tunnel and flight-test data, and design evaluation. Desires position as aerodynamicist concerned with aircraft stability and automatic guidance problems.

614. Experimental Test Pilot—Available immediately for any research problem or experimental project in helicopter or conventional types of aircraft from small personal craft to four-engined or pursuit, land or sea. One thousand hours' experimental time in helicopters and military types of pursuit and multiengined. Six thousand hours' pilot time with 4,500 hours certified. Pilot since 1921, licensed since 1928. Formerly, Chief Test Pilot and Assistant Chief Experimental Test Pilot for prominent companies. Excellent experimental training in all phases of such operations, with high percentage of data obtained satisfactory to engineering. Checked out at Mayo Clinic altitude chamber and centrifuge with above average record. Commercial, single, and multiengined land, single-engined sea, and flight instructor ratings. Detailed résumé on request.

613. Administrative or Executive Engineer—Registered Professional Aeronautical Engineer, with over 8 years of broad administrative, supervisory, and some design experience, desires

executive or administrative position in either prime or assisting capacity. Will definitely consider position in other than aircraft or allied industry, or any position requiring initiative, responsibility, and a combination of business and engineering experience and training. No objection to traveling. Geographical location unimportant.

612. **Airline Engineer**—Age 35, A & E licenses, Aeronautical degree; approximately 10 years' experience in maintenance and maintenance engineering with a major air line and recent experience as Assistant Chief Engineer for company manufacturing aircraft testing equipment. Seeks position with an air-transport company or manufacturer of aircraft equipment where intimate knowledge of air-transport maintenance problems and procedures will be of value.

611. **Manufacturing Executive**—M.E.; 26 years' experience in production management. Thoroughly familiar with all phases of modern methods and precision machinery, tooling, production control, procurement, and plant organization. Automotive and aircraft manufacturing background. Experience covers both aluminum and molded plywood construction.

610. **Aeronautical Engineer**—B.Ae.E., Rensselaer Polytechnic Institute. Age 22, single. Since July, 1945, connected with prominent East Coast light-plane producer as engineer. Experienced in structural design, aerodynamics, stress analysis, static testing, writing of reports for C.A.A. approval. Desires work associated with design and development of light planes. Associate member Sigma Xi, flying experience.

609. **Executive and Aeronautical Engineer**—Successful experience as Chief Engineer and in other responsible positions with major personal aircraft manufacturer. Well known by top industry and C.A.A. personnel; fully acquainted with C.A.A. procedure and operations and with industry methods and organization. Has also had successful management experience, and background of experience as ground instructor, pilot, A & E mechanic, navigator, radio operator, etc.; has thorough understanding of aviation from operator and private owner standpoint; and has acquired a sound working knowledge of factors affecting sales and advertising, purchasing, manufacturing, development, etc., with a keen insight into the industry's problems for the future.

603. **Engineer**—M.S. in A.E. Aircraft structures engineer, 26 years old, married. Has 2½ years' experience in the design of machine test equipment and 1½ years in responsible position as structures engineer for A.A.F. at Wright Field. Interested in position with Eastern or Midwestern aircraft company, or on staff of Eastern college. Qualified to teach mechanics, strength of materials, and airplane design.

600. **Aeronautical Engineer-Pilot**—Associate in Arts in Ae.E.; Chinese, 23 years of age, single. Cambridge Senior School Certificate (local), London, England. Experienced in layout, structural design, C.A.A. requirements, forging design. Has pilot's license and experience in maintenance of light aircraft and engines. Can translate French and Spanish (speaks both slightly), and speaks English fluently. Now Assistant Stress Analyst to Staff Engineer in well-known aircraft company. Desires engineering work with aviation company outside the United States. Willing to teach elementary engineering subjects. Will consider sales offer. Photograph, certificates sent on request.

599. **Engineering or Management Executive**—Engineer with 26 years' experience in aircraft engineering and manufacturing seeks responsible engineering or management connection with aircraft manufacturer. Previous positions in $12,000 range. Outstanding design, organizing, and managing ability. Familiar with Army, Navy, and commercial requirements.

596. **Technical Editor-Writer**—Graduate Mechanical Engineer. Has 1 year's experience in operation of low-turbulence wind-tunnel testing airfoils, flaps, and ailerons. Also has 4 years' experience writing and editing technical training material consisting of description, operation, inspection, maintenance, and test of airplane engine, flight, and navigation instruments. Desires position as editor-writer of technical material.

594. **Pilot-Engineer**—Degrees in both Aeronautical and Mechanical Engineering. Three years' experience in flight test engineering and 1 year in wind-tunnel testing. Experience in both performance and flying qualities flight-test methods. Commercial pilot with single and multi-engined land ratings. Total time 1,700 hours with majority military in wide variety of types. Interested in flying or combination of flying and engineering in Middle West or West Coast aircraft company, preferably in connection with commercial-type aircraft.

590. **Salesman**—Age 26. Education in Eastern preparatory school and university. Three years' air-line engineering, domestic. Desires position in aircraft sales (airplanes and/or airplane parts). Excellent personal and business contacts.

589. **Representative**—Chinese, technical engineer with degrees in Ae.E. and M.E. Completed Army Air Forces A. and E. maintenance and pilot training. 3 years' factory experience in aircraft engine development works includes 1 year of jet propulsion and gas turbine. Formerly Government official. Desires responsible engineering position or representation to China.

588. **Management or Administration**—Twenty-seven years old, single, A.B. degree, University of Pennsylvania. Major in political administration, courses applicable to business administration. Courses in industrial engineering including industrial relations, business and government, organization and organizational structure. Aeronautical engineering courses in elementary aerodynamics, performance calculation, aircraft drafting and engineering. Two and one-half years in aircraft testing in present position. Desires permanent position on junior level in management or administration with opportunity for advancement. Philadelphia area.

587. **Aeronautical Engineer**—B.S. in Aeronautical and Mechanical Engineering. Five years' experience as aircraft service engineer, including overhaul, manufacturing, and aircraft modification. Ex-Marine Captain. New York area preferred.

580. **Engineer**—E.E. Seeks research, development, or administrative position in New York City or Long Island. Ten years' experience includes aircraft controls, ignition, servomechanisms and industrial electronics. Qualified to hold position requiring considerable administrative or supervisory ability. Will accept position of lesser responsibility with reasonable assurance of advancement.

578. **Aeronautical Engineer**—B.S. in M.E., aeronautical option, 1942. Four years' experience large-scale wind-tunnel testing and research work on propellers, air-cooled engine installation, airplane stability and control and general aerodynamics. Now engaged in supersonic flight-test work. Desires position in Middle West. Prefers research and development work in high-speed aerodynamics.

Aeronautical Reviews—Wind Tunnels and Laboratories

(*Continued from page 73*)

Potential Flow Apparatus. W. T. O. Lewis. *Aeronautics*, Vol. 15, No. 5, December, 1946, pp. 29–34, figs. 7 references.

What can be done with potential-flow apparatus that uses an electrical method of examining the field of fluid flow around bodies of various shapes is shown. Some of the precautions that have to be taken into consideration and the limitations of such work are pointed out. The theory is treated lightly with only sufficient explanation to show the derivation of the equations used. The use of a specially designed potential-flow tank was developed to determine the flow past circular cowlings for radial aircraft engines, because the mathematical treatment of the subject had proved to be inadequate. Graphs show the results of cowling and spinner tests.

Effects of Compressibility and Large Angles of Yaw on Pressure Indicated by a Total-Pressure Tube. Milton D. Humphreys. *U.S., N.A.C.A., Restricted Bulletin No. L5C30 (Wartime Report No. L-77)*, April, 1945. 16 pp., diagrs. 1 reference.

Review of Hot Wire Anemometry. J. B. Willis. *Australia, Council for Aeronautics, Report ACA-19*, October, 1945. 22 pp., figs. 33 references.

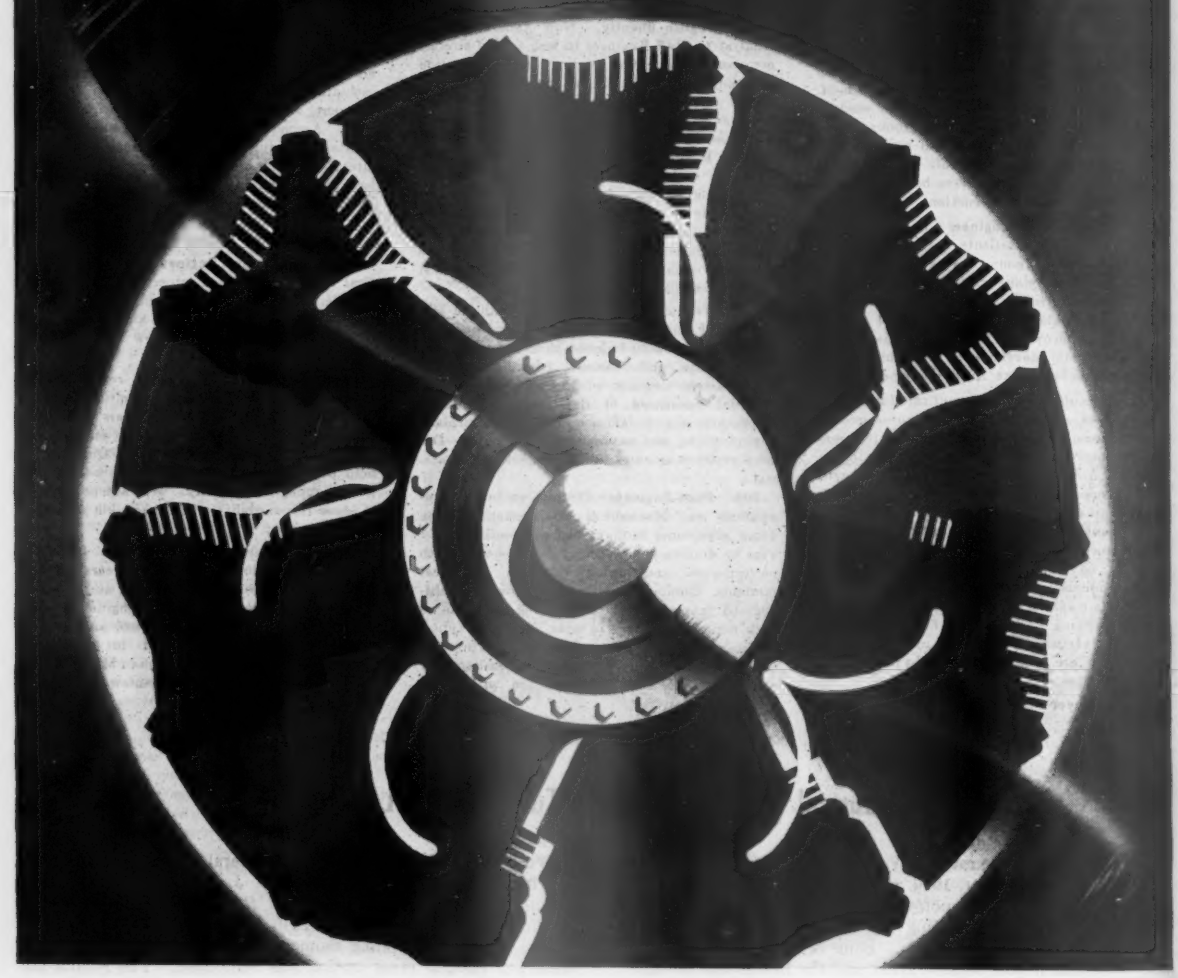
The use of hot-wire anemometers for steady and fluctuating velocity measurements, with particular reference to the characteristics of turbulence in wind-tunnel air streams. Limitations and errors in the various techniques are noted, and comparisons made where possible.

Wind Tunnel Interference on the Lateral Derivatives l_p, l_r and l_t with Particular Reference to l_p. J. M. Evans. *Australia, Council for Scientific and Industrial Research, Division of Aeronautics, Report A. 41*, March, 1946. 41 pp., figs. 5 references.

The interference rolling moment on a wing rolling in a wind tunnel of circular cross section was computed. The results are given for three straight tapered wings at three aspect ratios, but they can be simply modified for application to a wing of any aspect ratio and section lift curve slope. The method used is exact within the framework of the usual assumptions made in tunnel interference calculations. Using these results, the interference on a wing in a tunnel of rectangular cross section was determined by conformal mapping of the interior region of the rectangle onto the interior of a circle. The concept of an "equivalent" wing in a circular tunnel is introduced to simplify the calculations. Results are given for the tapered wings referred to with an aspect ratio of 6 but in a 9-ft. by 7-ft. rectangular tunnel at 0° and 90° angle of bank. The interference is such that it apparently increases the damping derivative in roll for closed tunnels and reduces it in the case of open tunnels. The results for a rectangular tunnel are not much different from those for a circular tunnel.

Refrigerated Altitude Chamber for Aircraft Testing (North American Aviation, Inc.). L. P. Spalding. *Automotive and Aviation Industries*, Vol. 95, No. 11, December 1, 1946, pp. 33, 67, 68, 70, 74, illus. (Cf. AER 8/46:83.)

Molybdenum steels make dependable aircraft engine parts economically practicable.



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